Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources

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OCCURRENCE AND DISTRIBUTION OF PLATINUM-GROUP ELEMENTS IN BRITISH COLUMBIA

Compiled by V. J. Rublee
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OPEN FILE MAP 1986-7 1:2 000 000 SCALE
Platinum Group Element Occurrences in British Columbia

INTRODUCTION

Platinum-group occurrences in the Canadian Cordillera are poorly documented, and with the exception of the Tulameen Ultramafic complex, superficially studied. The main sources of information available on the platinum potential in British Columbia were investigations undertaken by the Munition Resources Commission in 1920, and the Canada Department of Mines in 1934. From this framework, publications by the Geological Survey of Canada, British Columbia Ministry of Energy, Mines and Petroleum Resources, United States Geological Survey, Industrial Sector, and unpublished thesis material aided in substantiating, and detailing the platinum-group mineral inventory of British Columbia.

The classification of platinum-group element deposits used in this report is given in the following Table:

Primary Classification of Platinum-Group and by-Product deposits (after Cabri, 1981):

A. PGE-dominant deposits	B. PGE Co-product and bi-product deposits
1. Merensky-type	1. Alpine-type and derived placers
2. Layered Chromite	2. Ni-Cu magmatic sulphides
3. Alaskan-type and derived placers	3. Miscellaneous deposits

In British Columbia, platinum-group mineralization occurs within Alaskan-type and derived placers, Alpine-type and derived placer, Ni-Cu magmatic sulphide, and Miscellaneous deposits.

ALASKAN-TYPE PLATINUM-GROUP ELEMENT OCCURRENCES AND THEIR DERIVED PLACERS

Alaskan-type ultramafic complexes are crudely zoned, steeply dipping intrusions emplaced into either stable platform (hence 'Aldan'-type zoned complexes) or orogenic ('Ural'-type) environments. The bodies, roughly circular in cross section, consist of dunite to peridotite cores rimmed by a pegmatitic hornblendite, with successive intermediate shells of peridotite, olivine pyroxenite, hornblende pyroxenite and clinopyroxene hornblendite. The alkalic petrochemistry, highly calcic pyroxenite, abundance of hornblende, and absence of orthopyroxene and plagioclase, characterize and differentiate Alaskan-type bodies from Alpine ultramafic and stratiform intrusions (Crocket, 1971).

Two parallel north-northwest trending belts containing zoned ultramafic bodies occur in the northern Cordillera (Fig. 1). The most westerly belt, which occurs within the Alexander Terrane, consists of 52 zoned plutons which extend for 560 kilometres from Kodiak Island to south of Prince Rupert, British Columbia. The Turnagain, Polaris and Tulameen complexes within the Quesnel Terrane constitute the eastern, British Columbia Belt.

Worldwide, this type of ultramafic rock suite is a significant source of platinum-group elements (specifically platinum, osmium and iridium) and may carry up to 10 grams per tonne total PGE (Crockett, 1982). Pt-Fe alloys, platiniridium and osmiridium are associated with chromitiferous forsterite dunites and pyroxenites, as well as sulphide and oxide phases as in the case of the Alaskan panhandle bodies. Derived placers are a significant source of platinum, palladium, osmium, ruthenium and iridium, as exemplified by the Goodnews Bay (Alaska), and Tulameen Complexes (British Columbia) from which total PGE produced exceeded 647,500 ounces and 20,000 ounces respectively (Barker et. al., 1982; Mertie, 1969). The Salt Chuck Mine on Duke Island in the Alaskan panhandle, produced in excess of 661,771 ounces of platinum and palladium as a by-product from copper ore (Barker et. al., 1982).

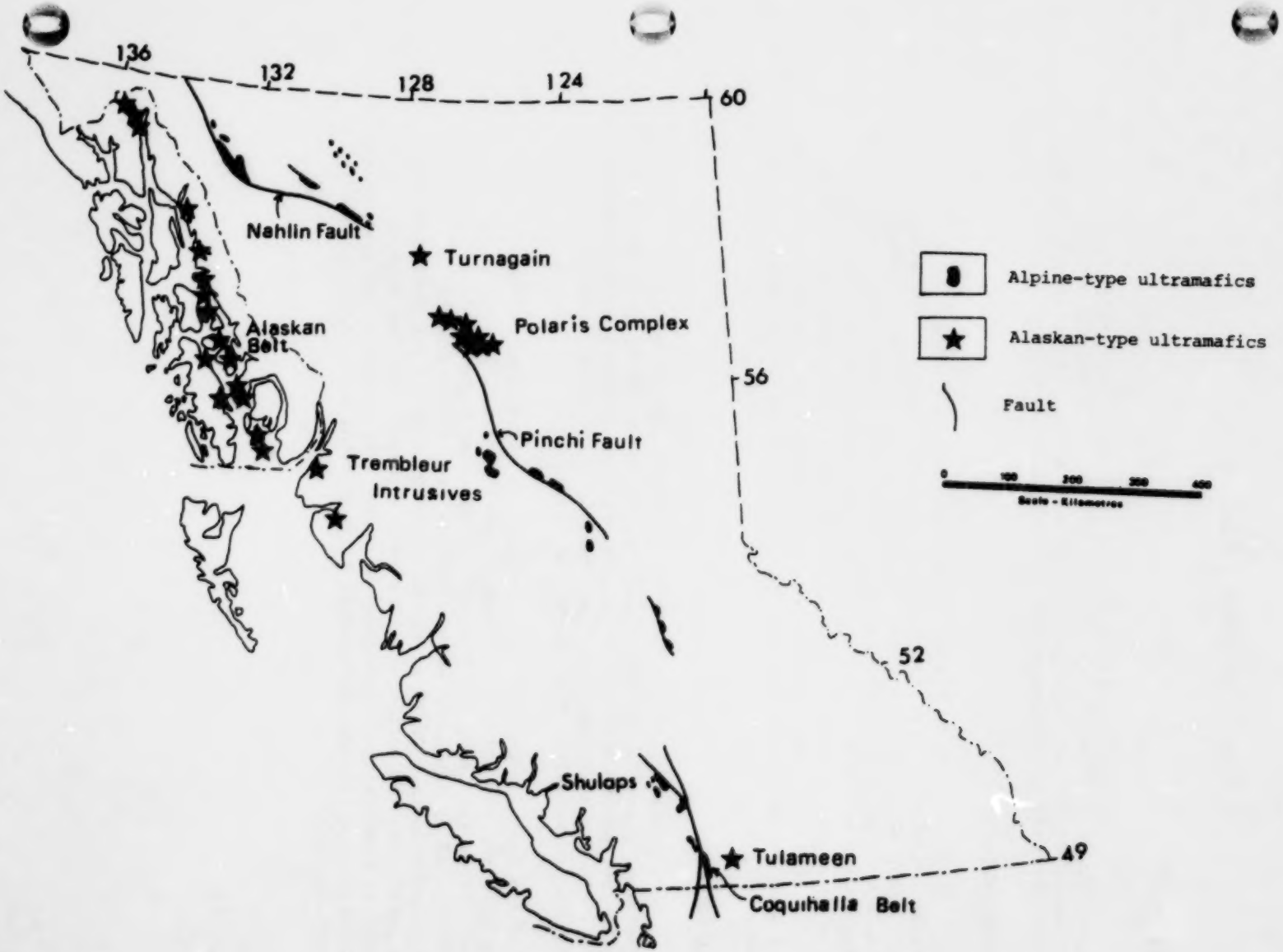

Figure 1. Alaskan and Alpine-Type Ultramafic Complexes in British Columbia (after McTaggart, 1971).

TULAMEEN COMPLEX

LOCATION

The Tulameen complex, exposed over an area of 60 square kilometres, is located on the Tulameen River, a tributary of the Similkameen River, approximately 24 kilometres east of Princeton, at the boundary between the Intermontane and Cascade Fold Belts.

REGIONAL GEOLOGY

The complex is a zoned, southeasterly elongated ultramafic-gabbroic body that has been emplaced into upper Triassic Nicola group metasedimentary and metavolcanic rocks. It is unconformably overlain by terrigenous sedimentary rocks and andesitic to basaltic flows of the Eocene Princeton Group. The Jurassic Eagle granodiorite,a phase of the Mount Lytton Batholith, lies to the west. The ultramafic complex has been assigned a mid Jurassic age on a basis of K-Ar determinations of 174 $\pm$ 4 Ma on hornblende by (Roddick, 1970), and of 186 Ma on biotite by (Leech, 1963).

LOCAL GEOLOGY

Ultramafic rocks within the Tulameen intrusive form assymetrically zoned, steeply dipping plugs, enclosed by an older alkalic (potassium rich, silica undersaturated) gabbroic suite (Findlay, 1969). Findlay describes the distribution of the three areas of ultramafic rocks within the complex as follows:

> "In the northern part of the complex, the ultramafic units display the characteristic zonal pattern of similar intrusions in Alaska and U.S.S.R., comprising a dunite core surrounded by shells of olivine pyroxenite and hornblende clinopyroxenite. South of the Olivine Mountain, where dunite is not exposed, the two main ultramafic zones contain a median zone of olivine clinopyroxenite bounded by hornblende clinopyroxenite. In the Tanglewood Hill area, hornblende clinopyroxenite is the ultramafic rock exposed."

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

(i) Lode Occurrences

A Study of the geochemistry of PGE within the Tulameen complex, undertaken by St. Louis (1984), demonstrated the distribution of PGE to be a function of the degree of differentiation (zoning) within the ultramafic intrusive. The highest platinum, iridium, osmium and rhodium values were obtained from dunites, peridotites, and their altered (serpentinized) equivalents; the pyroxenites and hornblendites were depleted (St. Louis, 1984). Palladium appears to be confined to the marginal phases (hornblende clinopyroxenite and hornblende) and enclosing gabbroic rocks (Fig. 3).

In addition to studying the relative abundance of the PGE in the various lithologies, St. Louis analysed the PGE. The analytical results of the quantitative analyses, presented in Table 1, clearly demonstrate Pt, Ir, Os and Rh enrichment in the chromite-rich and serpentinized samples.

Mineralogical study by (St. Louis,) of the chromite-rich rocks (dunite) defined three modes of occurrence of the PGE: 1) as inclusions (predominantly Pt-Fe alloys - Pt_xFe, tulameenite - Pt_2FeCu, platinum, and genkinite - $(Pt,Pd)_4\ Sb_3$) within chromite grains, 2) as anhedral grains (commonly sperrylite $PtAs_2$, irarsite-IrAsS, and associated Fe-Ni sulphides) interstitial to chromite grains and uncommonly 3) as platinum group metals exsolutions from chromite grains.

Platinum group elements and observed sulfide enrichment in serpentinites and serpentinized dunites may indicate remobilization and concentration of the PGE as well as Ni, Fe, As and S during the process of serpentinization (St. Louis, 1984). The restricted distribution/partitioning of palladium into the least mafic phases (later stage differentiates) may be attributed, as proposed by St. Louis, to the siderophile character of palladium or its affinity for more siliceous rocks. The significance of temperature control on the distribution of the platinum group elements in the Tulameen Complex is suggested by the association of Pt, Ir, Rh and Os with high temperature chromite and the partitioning of Pd into the lower temperature (less refractory) phases. As described by St. Louis, (1982, page 221):

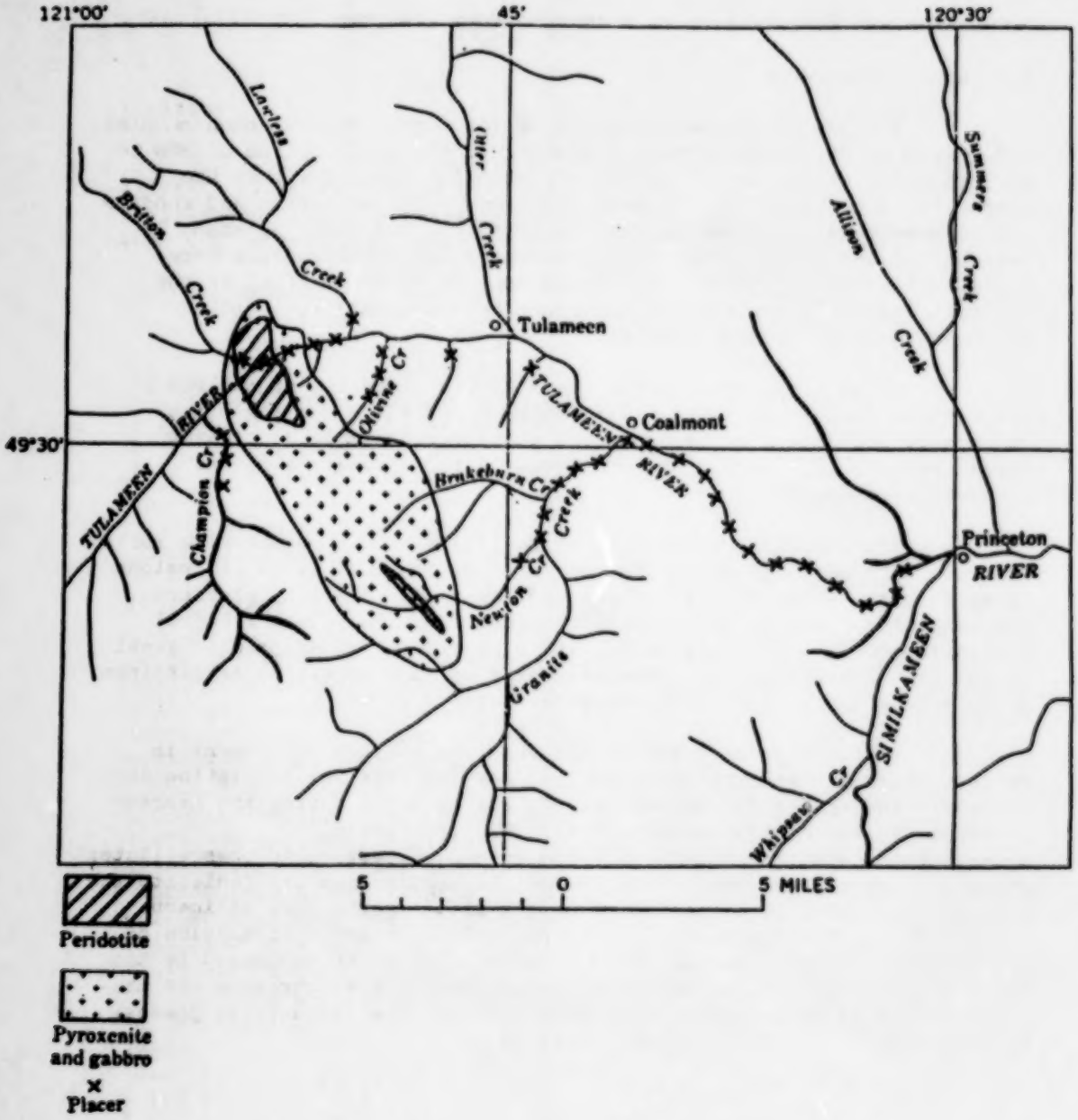

Figure 2. Generalized geology and rivers and tributaries with placer platinum in the Tulameen area (after Mertie,1969).

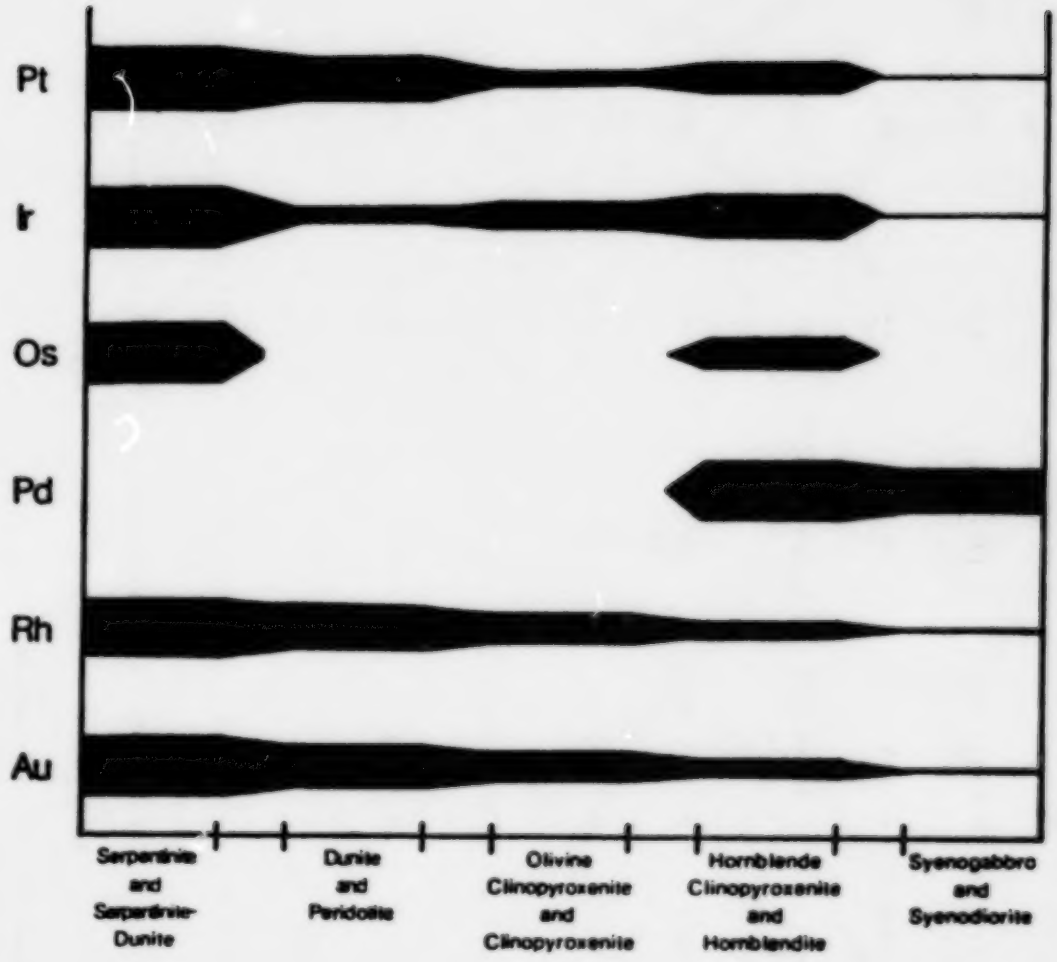

Figure 3. Distribution of the Noble Metals in the Tulameen Complex (after St. Louis ,1984).

TABLE 1

NOBLE METAL CONTENTS BY LITHOLOGY (WEIGHTED MEAN VALUES IN PPM AT 95% CONFIDENCE LEVEL) AFTER ST. LOUIS, 1984

Lithology	Pt	Ir	Au	Os	Pd	Rh
Dunite and peridotite	55.9±1.7 (30)	0.103±0.001 (33)	0.174±0.002	BLQ	BLQ	1.01±0.02 (31)
Serpentinite and serpentinite-dunite	150.4±3.6 (10)	2.62±0.01 (11)	0.22±0.001 (10)	2.6±1.1 (2)	BLQ	1.47±0.05 (11)
Dunite, peridotite, serpentinite, and serpentinite-dunite	72.8±1.5 (40)	0.105±0.001 (44)	0.209±0.002 (43)	2.6±1.1 (2)	BLQ	1.13±0.02 (42)
Olivine clinopyroxenite and clinopyroxenite	33.7±3.6 (2)	0.15±0./01 (1)	0.20±0.01 (2)	BLQ	BLQ	0.45±0.06 (2)
Hornblende clinopyroxenite and hornblendite	16.4±5.9 (1)	0.01±0.01 (1)	0.30±0.01 (1)	BLQ	24.5±15.9 (1)	0.1±0.1 (1)
Magnetite-rich	37.6±2.8 (7)	0.25±0.011 (4)	0.19±0.01 (7)	1.9±0.4 (5)	42.9±17.8 (1)	0.34±0.05 (5)
Syenogabbro and syenodiorite	24.4±5.1 (2)	0.10±0.01 (3)	0.10±0.01 (1)	BLQ	BLQ	0.2±0.1 (1)
Sulfide-rich	43.9±3.3 (4)	0.13±0.01 (3)	1.15±0.01 (5)	1.8±1.0 (1)	55.3±7.2 (5)	0.23±0.05 (3)
Chromite-rich	837.5±10.8 (6)	24.9±0.1 (7)	2.01±0.03 (7)	23.1±4.5 (3)	BLQ	47.8±0.1 (7)
Average[1]	8.79±0.92	0.032±0.002	0.039±0.002	0.39±0.11	14.47±3.29	0.09±0.02
Average[2]	57.7±1.1	0.106±0.001	0.204±0.002	1.98±0.38	49.2±6.2	0.89±0.02

[1]weighted on the volume percentages of the lithologies
[2]weighted on the number of samples of each lithology

Number of samples given in parenthesis

"Overall, Findlay (1963) found the highest concentrations of Pt in dunite and peridotite. In rock samples, he found the highest Pt content to be 0.225 gram per short ton in dunite on Olivine Mountain. The background Pt content in the dunite is 0.08 to 0.09 gram per short ton (Findlay, 1963). Chromite segregations within the ultramafic rocks returned the highest value of 7.34 grams per short ton Pt".

OTHER PLATINUM LODE OCCURRENCES IN THE TULAMEEN DISTRICT

Platinum values of 4.29 grams per tonne (Kemp, 1902) were obtained from sheared granites along Siwash Creek, which enters the Tulameen River 4.8 kilometres upstream from Eagle Creek. An assay of 137 grams per tonne platinum (O'Neill and Gunning, 1934) was returned from a trial carload of copper ore mined from skarnified Nicola limestones at Law's Camp, due north of Grasshopper Mountain. Copper Sulphide mineralization in a 60 foot greenstone dyke on Newton Creek, a tributary of Granite Creek, was analysed and returned a value of 8.57 grams platinum per tonne of sulphide.

(ii) Placer Occurrences

From 1889 to 1891 the Tulameen District, with an average annual output of 1500 ounces, was recognized to be the most important producer of platinum in North America; all production came from placer operations. Production continued intermittently until 1936 with an estimated total output of 20,000 ounces (Uglow, 1920). Rice (1947) describes the occurrence of platinum in the placers as follows:

"The ratio of platinum to gold is about 1 to 4 in the Similkameen and lower reaches of the Tulameen River, but increases upstream to where, near the mouth of Olivine Creek, the platinum is about equal in amount to, or may even exceed, the gold. On the whole, however, the platinum is of lesser importance. Platinum nuggets are never flattened and rarely even sub-angular, but occur in small rounded grains resembling fine shot, and mostly of uniform size. These nuggets are smaller than the gold on the average, but at the same time the platinum does not occur in fine, flaky particles. Most of the pellet-like nuggets have a roughly pitted surface; many show adhering grains of chromite and magnetite; and olivine and pyroxene are occasionally attached to them."

Alloys of Pt and Fe comprise the major platinum group metals in the placer; with minor Ir, Rh, Os, Cu, Pd and Ni substitute for Pt (Raicevic and Cabri, 1976). Palladium contents are not significant. Figure 2 shows the location of platiniferous creeks and rivers in the Tulameen District.

TULAMEEN DISTRICT

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ALPINE-TYPE AND DERIVED PLACERS

Alpine-type ultramafic bodies are dismembered basal portions of ophiolites that have been tectonically emplaced in an orogenic belt. Lenses and pods of dunites and peridotites serpentinized to varying degrees are stretched out along major fault zones such as the Coquihalla, Hozameen, Fraser, Pinchi and Nahlin, all of which are associated with oceanic volcanic and sedimentary rocks of the Cache Creek and Slide Mountain Assemblages (Figure 1).

The concentrations of platinum-group elements in Alpine-type bodies, lower than those in Alaskan-type complexes, are closely associated with chromites and may be associated with magnetite and sulphides. The predominance of osmium and iridium and the absence of palladium in the chromitiferous dunites and peridotites reflects the low degree of differentiation within the magma as "an increasing Pt:Ir ratio is the characteristic trend expected in the normal crystallization in mafic magmas" (Crocket, 1982). The affinity of Os, Ir and Ru for chromites, which occur as lenses, pods and schlieren within the basal cumulus dunites has been attributed to their substitution for Cr^{3+} in chrome spinel (Crocket, 1982).

Within the cumulus gabbros, which overlie the tectonized harzburgites and lherzolites that compose the basal portion of the ophiolite, minor sulphide concentrations may provide a significant target for Pt and Pd. The process of fractional crystallization increases Pt and Pd concentrations, hence sulphide saturation of the magma "could potentially scavenge Pt and Pd when their concentration was at a maximum" (Crocket, 1982, page 57).

SCOTTIE CREEK

LOCATION

The chromite deposit on Scottie Creek is located approximately 6.4 kilometres from its confluence with the Bonaparte River, 32 kilometres north of Ashcroft.

REGIONAL GEOLOGY

The Scottie Creek property is situated within the Intermontane Belt near the eastern margin of the Cache Creek Assemblage. This eastern Cache Creek Belt of Pennsylvanian to Triassic radiolarian ribbon cherts, limestones, pillowed basalts, gabbro and serpentinized ultramafic rocks are bounded to the east by Eocene to Miocene Kamloops Group dacites and basalts and to the west by the Fraser River Fault. Small bodies of serpentinized dunites and peridotites are associated with the Cache Creek rocks,and occur in a northerly trending belt approximately 1/4 mile wide, that outcrops on "both sides of Bonaparte Valley from south of Cache Creek to Clinton" (Duffell and McTaggart, 1952, page 76). According to Wright et al. (1982), 85 ultramafic bodies have been mapped, ranging in size from a few to 300 metres in maximum dimension. The smaller bodies are extensively sheared, slickensided and completely serpentinized whereas the larger ones at Fergusson and Scottie Creeks are relatively unsheared. "Dunite forms more than 85% of the ultramafic rocks, and peridotite more than 10%. Dyke-like pyroxenite bodies appear to cut across dunite and peridotite," (Wright et.al., 1982, page 1169) at Fergusson and Scottie Creeks.

LOCAL GEOLOGY

Chromite occurs as disseminated grains, massive lenses and tabular sheets within the irregularly spaced pods of faulted, serpentinized dunites. As described in the British Columbia Minister of Mines Annual Report for 1915 (page 285):

> "The portion of Scottie Creek that the writer examined carefully is about three miles and a half above the mouth, where a deposit of chrome-iron ore occurs in the first range of hills back from the creek on the north side on right limit. These hills are made up chiefly of ridges and knolls of altered peridotite, carrying a large percentage of chrysolite, and decomposed magnesian rocks, greasy and very light colored, with tints of green, yellow and brown. The erosion has

been so extensive as to cut a series of deep gulches through the hills, leaving many of the knolls isolated from the main range of hills and with sharp peaks and precipitous sides. This erosion has laid bare the iron ore on the sides of some of the knolls and the points remaining between the gulches, so that the outcroppings can be followed from point to point in an easterly direction for a considerable distance. Sometimes the outcroppings occur as solid masses or beds of ore; at other placers as nodules of varying sizes, some quite large, mixed with the decomposed rock."

As Wright et al. (1982, page 1169) observed: "At Scottie Creek, most chromite layers strike southwesterly and dip gently northwest, whereas at Ferguson Creek, 2.5 kilometres south of Scottie Creek, layers strike northerly and dip 50° east. This would be expected in separate blocks in a melange."

Southwest of the chromite bodies exposed in Chrome Creek are outcrops of Miocene basalts and augite andesites.

DISTRIBUTION AND OCCURRENCES OF PLATINUM-GROUP ELEMENTS

Samples of chromite ore obtained from deposits on Chrome Creek (north fork of Scottie Creek) returned values of 3.4 and 0.69 grams per tonne platinum (Thomlinson, 1920, page 179). Panned samples from bars and old diggings on Scottie Creek located 2.4 and 5.6 kilometres upstream from the confluence of Scottie Creek and Bonaparte River returned values of 4.8 and 1.37 grams per tonne platinum (Thomlinson, 1920, page 178). Two panned samples taken 0.4 and 0.8 kilometre up from the mouth of Chrome Creek produced 2.06 ounces per ton platinum each (Thomlinson, 1920, page 178).

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KEEFERS

LOCATION

The Keefers PGE occurrence is located on the north side of Nahatlach River, approximately 6.5 kilometres northwest of its confluence with the Fraser River, 27 kilometres due south of Lytton. The workings are located at 370 metres elevation.

REGIONAL GEOLOGY

In the vicinity of Keefers, a northwest trending serpentine belt occurs within a sequence of greenstones, quartzites, limestones and phyllites. It is bounded by the Cretaceous age granitic rocks of the Coast Plutonic complex on the west, and the Fraser River Fault on the east.

DISTRIBUTION AND OCCURRENCE OF PLATINUM-GROUP ELEMENTS

A description of the property geology and mineralization is unavailable, except for a brief account provided by the National Mineral Inventory (1975), as follows:

> "The showings were discovered and staked by D. Pride in 1954; some open cutting was done at that time. Northwest Ventures Ltd. optioned the 23 claim property in 1955 and some surface work and diamond drilling was reported. A representative sample, sent by the company to Sudbury for assay, is reported to have returned values of 1.42 percent copper, 2.24 percent nickel, 0.15 percent cobalt, and 0.11 ounce platinum and 0.023 ounce palladium per ton."

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MASTODON

LOCATION

The Mastodon chromite property is located 4.8 kilometres southeast of Christina Lake and 19.2 kilometres southeast of Grand Forks at an elevation of 900 metres on the southwest slope of Cascade Mountain. The best showings are located adjacent to the Grand Forks - Rossland Highway, 10 kilometres southeast of Cascade (Stevenson, J. S. 1941).

REGIONAL GEOLOGY

Mastodon is located near the eastern margin of the Quesnel terrane within the Omineca Crystalline Belt. Paleozoic to late Triassic Anarchist assemblage and early Jurassic Rossland group volcanic arc and marine sedimentary rocks are complexly faulted and intruded by Jurassic Nelson granites and Eocene Coryell alkalic plutons in the vicinity of the Mastodon property. Tectonically emplaced serpentinized dunites and pyroxenites are confined to the Anarchist assemblage (Peatfield, 1978)

LOCAL GEOLOGY

Small Lenses of chromite occur within a serpentinized dunite which is associated with greenstone breccia, tuffs and flows. The Jurassic Nelson granites and associated diorite and porphyry cut the ultramafic body to the south-southeast of Cascade Mountain. Chromite occurs as irregular disseminations, long streaks (schlieren) and small lenses within the ultramafic body. The larger chromite lenses are aligned within the hanging wall of a northeast striking, southwest dipping fault zone, (Stevenson, 1941); the ultramafic body is associated with the Paleozoic arc and oceanic facies rocks; hence Peatfield (1978) designated these chromite-nickel bearing ultramafic bodies as 'alpine-type'.

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Samples of chromite ore were taken by Wm. Thomlinson (1920, Page 106) from several crown granted claims that are underlain by serpentinite. The results are as follows:

Cerargyrite Crown Grant

Fine green serpentine with some oxides of iron and altered rock, from the face of an open-cut near the bottom and from upper sides of a lens of chromite. Platinum - nil.

General sample of chromite on dump and in the lens. Platinum - trace.

Midnight Crown Grant

From open-cut toward north end of claim banded chromite enclosed in fine green serpentine. Platinum - .514 grams per tonne.

Blacktail Fraction

From the main workings, open-cuts on the north lens of ore. Soft reddish-brown oxidized material from streaks in the serpentine and from the lenses of chromite. Platinum - trace.

Blacktail Crown Grant

From the main workings, open cuts on the north lens of ore. General sample of chromite being taken out for shipment. Platinum - 0.69 grams per tonne.

Mastodon Crown Grant

Fine line of open-cuts where chromite was being mined for shipment. Soft altered rock with some firm serpentine containing grains of chromite. Platinum - trace.

From all the main workings, open-cuts. General sample of chromite being mined for shipment. Platinum - trace.

Blacktail

From open-cuts on north lens of ore. Special sample of granular chromite enclosed in amethyst coloured spar. Platinum - trace.

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Cu-Ni SULPHIDE OCCURRENCES OF PLATINUM-GROUP ELEMENTS

In this class of deposits, the platinum group elements palladium and platinum occur as sulphides and sulfarsenides associated with pentlandite, pyrrhotite and chalcopyrite mineralization in gabbroic and related rocks. Pentlandite and pyrrhotite act as concentrators for palladium (Crocket, 1982). A positive correlation between Pd and Ni is evidenced by 'the mutual dissolution of Ni and Pd from pyrrhotite at sub-solidus temperatures' (Stumpfel and Tarkian, 1982). Chalcophyrite has been suggested (Crocket, 1982) to be a concentrator for platinum, however this is as yet unproven.

TOFINO NICKEL (RAINEY-PEARL)

LOCATION

The Tofino Nickel property is located opposite Similar Island on the west side of Deer Bay, in Tofino Inlet. The property is reached by boat 25 kilometres east-northeast from Tofino on the west coast of Vancouver Island.

REGIONAL GEOLOGY

The property, located on the western edge of the Insular Belt, is underlain by amphibolitic gneisses of the West Coast Crystalline complex (Muller, 1977). The gneisses are considered to have been derived from migmatization of Paleozoic eugeosynclinal rocks during a major Jurassic plutonic event. A U-Pb date obtained from well foliated quartz plagioclase biotite gneiss at Grice Bay, 15 kilometres southwest of the Tofino Nickel property gave a late Paleozoic age of 264 Ma (Muller, 1977).

LOCAL GEOLOGY

Amphibolite is exposed as lenses and dyke-like bodies (Mason, 1984) within a feldspar gneiss of the West Coast Complex. According to Stevenson (undated):

> "The (gneissic) feldspar porphyry is the main rock in the stripping and also in the area extending for at least one-half mile easterly from it. The amphibolite occurs as remnant lenses that strike northwesterly and dip approximately 60 degrees southwestward, an attitude that is steeper but which roughly corresponds to the slope of the hillside, an important feature to be considered in prospecting the showing. The amphibolite appears to be a metamorphosed basic rock, probably originally basaltic to andesitic lava. The feldspar porphyry is a white rock, slightly gneissic in texture but otherwise lacking structure; the gneissosity strikes northwesterly. Replacement of the amphibolite by the feldspar porphyry is well shown at the lower end of the stripping."

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Pyrrhotite, chalcopyrite, pyrite and magnetite mineralization with nickel, platinum and palladium values is associated with the amphibolitic rocks. As described by Stevenson (undated):

> "The pyrite occurs as scattered patches with ill defined borders to the amphibolite. The pyrrhotite occurs as patches and thin veinlets that form a lace-work in the amphibolite. The chalcopyrite occurs as small distinct lenses of nearly pure mineral, which range from one-half inch to 4 inches in width and from a few inches to 18 inches in length. The chalcopyrite lenses are well defined in the mineralized area and appear to be later than the other sulphides. The sulphides occur in two areas in the stripping, one, towards the upper end, measuring approximately 4 feet by 12 feet by 2 feet deep and the other towards the lower end, measuring 4 feet by 10 feet by 2 feet deep. Elsewhere the amphibolite is either relatively barren of minerals or may contain a little pyrite. The amphibolite, probably as lava, appears to have received the sulphide mineralization before the formation of the feldspar porphyry.

Samples of the sulphides and mineralized amphibolite taken by Stevenson returned values of up to 6.7 grams per tonne platinum and 9.8 grams per tonne palladium. Eastwood (1963), obtained 6.2 grams per tonne palladium and trace platinum from a grab sample of rock well mineralized with pyrite and chalcopyrite.

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KITKAT

LOCATION

The Kitkat claim block is located on the west side of the Nitinat River approximately 5 kilometres southeast of Mt. McQuillan. The property can be reached from either Port Alberni (29 kilometres northwest of Kitkat) or Youbou (32 kilometres southeast) along Crown Forest Industries Ltd's Nitinat-Main Road.

REGIONAL GEOLOGY

The Kitkat property is situated on the north-northwestern edge of the Cowichan-Horne Lake Uplift which exposes Paleozoic age island arc volcanics and sedimentary rocks of the Sicker Group. The area is complexly block faulted; it is bounded on the southwest and northeast by parallel eastward-directed thrust faults. Isoclinal folds with north-northwest trending axis are associated with the episode of uplift which occurred at the end of the Paleozoic (Muller and Carson, 1968).

LOCAL GEOLOGY

Specific details of the property geology are lacking because the showings are a very recent discovery. According to Muller and Carson (1968), Pennsylvanian and older eugeosynclinal rocks of the Sicker group underly the area in the vicinity of the claims.

OCCURRENCE AND DISRIBUTION OF PLATINUM GROUP ELEMENTS

Values of up to 1.65 grams per tonne platinum and 4.85 grams per tonne palladium as well as anomalous cobalt, chromium, copper and nickel values were obtained from irregular lenses, up to 4.5 centimetres in width, of semi-massive to massive stringer and disseminated pyrite and pyrrhotite within Sicker Group (George Cross Newsletter, 1985) basaltic volcanics. Malachite and azurite staining occurs on the gossanous weathering surface.

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GIANT MASCOT (PACIFIC NICKEL, BRITISH COLUMBIA NICKEL)

LOCATION

The Giant Mascot, formerly the Pacific Nickel nickel-copper mine, is located approximatley 10 kilometres north-northwest of Hope, at the head of the Stulkawhits (Texas) Creek which flows eastward into the Fraser River. Access is gained to the property along an 8.2 kilometer gravel road which intersects the Trans Canada Highway about 16 kilometres north of Hope.

REGIONAL GEOLOGY

Giant Mascot is situated on the eastern margin of the Coast Plutonic Complex, 3 kilometres west of the boundary with the Cascade Fold and Thrust Belt. The Hope fault, which follows this boundary, juxtaposes high grade metamorphic rocks of the Custer gneiss, on the eastern side, with upper Paleozoic Settler Schists and early to Mid-Cretaceous diorite and tonalites of the Spuzzum pluton, on the west (Monger, 1985). The metamorphic grade facies in the vicinity of Giant Mascot is sillimanite-almandine grade (Grove and James, 1974).

LOCAL GEOLOGY

Northerly trending, regionally metamorphosed Settler schists are intruded by a stock-like, crudely zoned ultramafic body enclosed by genetically related mid-Cretaceous Spuzzum diorites and tonalites (Aho, 1956). According to McLeod et al. (1976, page 115):

> "K/Ar ages from the Giant Mascot Ultramafic body (119-95 m.y.) suggest that it is slightly older than adjacent diorite and tonalite (78-89), which are shown to be members of the mid-Cretaceous Spuzzum Intrusions."

However, the contact relationships between the two intrusive suites are ambiguous (McLeod et al., 1976). The ultramafic, which extends for 2.9 kilometres in an east-west direction and 2.25 kilometers north-south, is comprised of seventeen dunite to peridotite-cored, pipe-like bodies enclosed within a pyroxenite mass. Hornblendite to pegmatitic hornblendite reaction margins, up to 100 metres wide (Aho, 1956), rim the pyroxenite. Later hornblendic and dioritic dykes cut the complex. The pipe-like ultrabasic structures vary in size from 15 metres by 15 metres to 60 metres by 100 metres; they broadly trend N75^{o}W and plunge steeply to the north.

OCCURRENCE AND DISTRIBUTION OF P.G.E.

Nickeliferous pyrrhotite, chalcopyrite and pentlandite are exclusively associated with the ultrabasic rocks and occur as massive to disseminated sulphides. The average grade of the sulphides (Aho, 1956) is 1.4 percent nickel, 0.5 percent copper, 1 percent chromium, 0.1 percent cobalt, 0.7 grams per tonne gold and 0.3 grams per tonne platinum metals.

Aho (1956) defined three types of ore bodies at Giant Mascot; zoned bodies of replacement origin, massive sulphide of magmatic derivation, and vein-like later stage mineralization. The zoned ore bodies are elliptical in cross-section and form sulphide cores with shells or rings parallel to the long axes of the dunite and olivine peridotite pipes with which they are associated. These steeply plunging ore zones exhibit nickel bearing cores and copper bearing outer zones (Aho, 1956). Massive orebodies are irregular in outline and occur as lenses between or along the ultramafic units within the intrusive (Groves and James, 1974); occasionally they grade into disseminated ore.

Chalcopyrite-rich, vein-like mineralization up to 5 centimetres in width is present within and adjacent to the orebodies; rarely, it extends into the country rock.

A second type of mineralization consists of, or occurs in, heavily mineralized late stage hornblendite and pyroxenite dykes which cut the peridotite. As described by Aho:

> "The pyroxenite dykes locally grade into the hornblendite dykes; sulphides within both are unevenly distributed and tend to be concentrated into massive blocks that extend irregularly like replacements into unaltered wall rocks. The sulphides are chiefly pyrrhotite, with smaller amounts of nickel and copper than sulfides in the ore bodies. In places the "Dykes" grade into massive sulphide "Veins". "

A sample taken from a pegmatitic massive pyrrhotite vein from the 1500 orebody assayed 2 grams per tonne platinum and 7.2 grams per tonne palladium (Eastwood and Waterland, 1966). The 1500 orebody possesses maximum horizontal dimensions of 60 metres by 20 metres and a vertical dimension of 105 metres. Tonnage and grade quoted for this deposit are 607,273 tonnes at 1.35 percent nickel and 0.45 percent copper (Christopher and Robinson, 1974). Christopher and Robinson (1974 page 112) summarized the geological setting of the 1500 orebody as follows:

> "Ore in both hornblende peridotite and hornblende pyroxenite occurs as both massive and lacy types with a concentration of massive near bottom; ore has been either dammed or cut off by a flat hornblendite dyke; the footwall contains a breccia with diorite fragments in mineralized hornblende pyroxenite".

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SWEDE

LOCATION

The Swede Property is located on Moresby Island on Swede Peninsula on the east side of Anna Inlet in Klunkwoi Bay. The prospect is accessed by air, approximately 60 kilometres southwest from Sandspit.

REGIONAL AND LOCAL GEOLOGY

The Swede claims are located on the western boundary of the Insular Belt, within the Wrangellia Terrane. The oldest rocks in the area are tholeiitic basalts, andesites and coarser diabase dykes of the Triassic Karmutsen Formation. These are unconformably overlain by massive and thinly bedded limestones and argillites of the upper Triassic to lower Jurassic Kunga Formation. The property is underlain predominantly by andesites and basalts which have been intruded by three episodes of diabase dykes (Wilson, 1965). Erratic mineralization occurs as disseminations, blebs and fracture fillings of chalcopyrite and minor bornite in diabase dykes of the Karmutsen formation.

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Platinum, with local assays to 0.34 grams per tonne, and trace palladium were reported to occur within sporadic bornite mineralization within the diabase country rock (Minister of Mines, B.C., Annual Report 1922, page G39). This reported occurrence of the platinum group elements has not been substantiated.

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DYKES OPTION (MINERAL DYKE)

LOCATION

The Dykes Option copper, platinum, palladium and nickel occurrence is located 1 kilometre northwest of the junction of Riondel Road with the Kootenay Bay - Crawford Bay Road (Hoy, 1980).

REGIONAL GEOLOGY

The property is situated on the western limb of the overturned Crawford antiform within the Kootenay Arc, a north trending regional structure of folded and thrust faulted Hadrynian to early Mesozoic age strata (Hoy, et al., 1985). The Dykes Option is contained within a north-south trending, 20 kilometres wide belt, of sillimanite-garnet-biotite grade metamorphism (Hoy, 1980).

LOCAL GEOLOGY

Calc-silicate gneiss with amphibolite, schist and impure marble layers of the Middle Cambrian Index formation of the Lardeau Group underlie the property. A flat lying diorite sill or dyke (Rice, 1941) has intruded the metasedimentary rocks. Pegmatite dykes cut the diorite intrusive (O'Grady, 1930).

OCCURRENCE AND DISRIBUTION OF PLATINUM GROUP ELEMENTS

Details of the mineralization and geology of the Dykes Option mineral showing are limited to brief descriptions by O'Grady (1930), Richmond (1931) and Rice (1941). Platinum, palladium, nickel and copper mineralization is reported to be present as disseminations within the diorite sill or dyke. The best showing, exposed in an 80 metre adit, occurs near the margin of the intrusive diorite (Rice, 1941); no assays are available.

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MISCELLANEOUS PGE OCCURRENCES

Platinum group-elements have been detected in trace to appreciable amounts in hydrothermal, alkalic-hosted, skarn, porphyry copper, and stratabound base metal environments in British Columbia.

The mobility of platinum-group minerals at low temperatures in aqueous solutions, and the extraction from silicates, oxides and sulphides during the process of serpentinization, has been studied by Stumpfl and Tarkian (1976). The mobility is such that in extreme situations PGE may be concentrated in "locations determined by geological structure, without any spacial relation to igneous rocks" (Stumpfl and Tarkian, 1982).

i) Hydrothermal Platinum-group Element Occurrences

Assays obtained from quartz veins and shear zones from the Cable and Nome claims, Mt. Ida property, and former Mother Lode Mine, range from 0.6 to 3.4 grams per tonne platinum. All of these hydrothermally related showings, prospects and deposits occur in areas where there has been regional extensional tectonic events within the Omineca Crystalline Complex.

CABLE CLAIM

The Cable Claim, is situated between Woodbury and Sunrise Mountains, at an elevation of 2300 metres on a northern tributary of the Silver Spray Creek. This region now lies within the boundaries of Kokanee Glacier Park.

The area is entirely underlain by granites of the Jurassic Nelson Batholith. An assay of 2.40 grams per tonne platinum (O'Neill and Gunning, 1934), was obtained from an auriferous quartz vein within the granite. Further details of the geology, mineralization and workings are unavailable.

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i) Hydrothermally Related Occurrences

NOME CLAIM

LOCATION

The Nome claim is located on the northeast side of Klowala (Cariboo) Creek which flows northeastward into Keen Creek, the south fork of the Kaslo River. The claim lies outside the northern boundary of Kokanee Glacier Park.

REGIONAL AND LOCAL GEOLOGY

The Nome claim lies on the eastern boundary of the Omineca Crystalline Belt, within the middle Jurassic Nelson Batholith. The property is underlain by a coarse grained granitic phase of the batholith which is cut by narrow, basic dykes (Cairnes, 1934).

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Assays of 2.74 grams per tonne and 1.71 grams per tonne platinum were obtained from grab-samples from a rock slide of granodiorite containing "specks and small masses of a hard, dark-colored mineral which appeared to be almost free from weathering effects, more so then the rock itself", (Thomlinson, 1920, Page 169). According to Cairnes (1935):

> "Workings include two adits about 200 feet apart (vertically), the lower follows a shear zone about 4 feet wide. The zone strikes north 35 degrees east, dips steeply to the northwest, and shows little mineralization other than pyrite which is partly oxidized near the surface. The upper adit lies 1300 feet to the southeast of the other and was inaccessible at the time visited (June, 1927), but appears, from the material on the dump, to have encountered somewhat similar conditions to those in the lower adit and is probably driven on a parallel shear".

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i) Hydrothermally Related Occurrences

MT. IDA

LOCATION

Three platinum group element occurrences - Bonnie Brae, Mount Ida and Sunset - have been documented on the north and northeast slopes of Mount Ida, 0.8 kilometres southeast of Salmon Arm.

REGIONAL AND LOCAL GEOLOGY

Mount Ida, situated within the Kootenay Terrane of the Shuswap complex, is tectonically bounded on the east by the Monashee complex and on the west by the Harper Ranch assemblage of the Quesnel Terrane.

Argillites and limestones of the Precambrian to Mississippian Sicamous Formation, which unconformably overly Cambro-Ordovician schists of the Silver Creek Formation, comprise the middle to upper stratigraphic portion of the Mount Ida group. This sequence is intruded by Cretaceous age granites of the Coast Intrusions which in turn are capped by basaltic lava flows of the Eocene Kamloops Group.

DISTRIBUTION AND OCCURRENCE OF PLATINUM GROUP ELEMENTS

Platinum values have been obtained from quartz filled shear zones along with copper, lead and zinc sulphides, within impure quartzites and schists, adjacent to dykes of feldspar porphyry. The mineralized zones occur as "a system of sub-parallel ore bodies 18 inches to 7 feet wide that generally strike north-east and dip from an angle of 45 degree to almost vertical towards the southeast" (Brewer, 1913).

Three mineralized localities exposed in workings on the north and northeast sides of Mt. Ida were sampled by W.F. Ferrier of the Munition Resource Commission in 1918 as a follow up to previously reported assays of 2.74 and 7.54 grams per tonne platinum. As reported by Ferrier in the Final Report of the Commission:

> "The first claims sampled was the White Cliff on the northeast slope of Mt. Ida, at an elevation of about 3,150 feet. Two tunnels have been driven. The upper one is a cross-cut 122 feet in length which has just reach the foot-wall of a vein at the face. About 100 feet below this another tunnel, 24 feet in length, follows a vein the dimensions of which were not satisfactorily determined. The strike is apparently northeast with a dip to the southeast. A cut was taken along the western wall of the tunnel to determine if platinum is present.

Sulphides, chiefly sphalerite, with some pyrite and galena, occur somewhat sparingly in the quartz. A second sample, consisting principally of these sulphides, was chipped at random from both walls of the tunnel to ascertain if the platinum was closely associated with the sulphides".

The assay results of these samples returned values of 13.03 grams per tonne gold, 1.03 grams per tonne platinum, and 3.42 grams per tonne gold, and no values in platinum repectively (Ferrier, 1920).

"The Mountain View claim was next visited and a sample taken in an open-cut near the eastern boundary of the claim, across the full width of the vein. The strike here is about east and west, with a dip of 60^{o} to the south, but Mr. Thornton stated that the vein had been traced through the White Cliff, running across four claims. The general character of the vein material resembles that seen at the White Cliff. As before, a second sample was taken here by cutting across the centre of the vein, which appeared to be the more highly mineralized portion".

Samples from the Mountain View claim assayed 12.0 grams per tonne gold, 6.86 grams per tonne platinum and 2.79 grams per tonne gold 0.69 grams per tonne platinum respectively (Ferrier, 1920).

The Miller tunnel, on the north side of Mt. Ida, was the location for two samples taken along the face of an exposed shear zone full of quartz stringers in a granitic rock. Ferrier (1920) reports:

"The face of the drift, which does not expose any walls, was sampled across its full width. Another sample was taken from a small highly mineralized streak in the face.

Sulphides, consisting of sphalerite, galena, chalcopyrite, and pyrite, appear to be more abundant in the quartz here than in that at the claims visited on the previous day".

Values of 8.23 grams per tonne gold and 0.69 grams per tonne platinum were recovered from the 4.75 foot cut across the full width of the face, and 4.80 grams per tonne gold and 1.03 grams per tonne platinum are reported from across the mineralized streak.

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i) Hydrothermally Related Occurrences

MOTHER LODE (BURNT BASIN)

LOCATION

The Mother Lode property located in the Burnt Basin area, is situated at the head of Josh Creek, a tributary of McRae Creek, about 1.6 kilometres southwest of Paulson Bridge on the Christina Lake - Kinnaird Highway.

REGIONAL GEOLOGY

Oceanic sedimentary and intercalated volcanics of the upper Paleozoic Mount Robert's formation (and possibly Upper Triassic Rossland Group) which underly the Mother Lode crown grant, are intruded to the northwest by Jurassic Nelson granites and to the southeast by the Tertiary Coryell batholith. This area is in a tectonic depression within the Omineca crystalline Belt, approximately 10 kilometres east of the Grand Forks Complex, which is bounded by Tertiary normal faults (Parrish et al. 1985).

LOCAL GEOLOGY

Limey argillites, limestones and greenstones of the Paleozoic Mount Roberts Formation are cut by granodiorite and basic gabbroic dykes related to the Jurassic Nelson and Eocene Coryell plutonic events. A quartz vein, ranging in size from two to six feet in width, contains pyrite, galena, sphalerite and some molybdenite; it is hosted by the greenstone, between two wide mafic syenitic dykes.

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Assays of the quartz vein performed by Baker and Company of Newark, New Jersey returned values from trace to 8.57 grams platinum per tonne (O'Neill and Gunning 1934, page 104). Subsequent resampling of the vein by the Geological Survey of Canada (O'Neill and Gunning,1934) indicated a platinum content of 3.43 grams per tonne

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ii) Alkalic Hosted Platinum-Group Occurrences

Platinum values at the Franklin Camp and Sappho property near Greenwood are associated with copper mineralization occurring within marginal shonknitic phases of Tertiary Coryell alkalic stocks in southeastern British Columbia. Both properties are underlain by oceanic volcanic and sedimentary rocks of Paleozoic to Jurassic age (and associated basic and ultrabasic bodies) of the Quesnel Terrane, that were intruded during the Jurassic time by Nelson granites and in Tertiary time by Coryell alkalic plutons. The Tertiary episode of igneous activity occurred during the waning stages of a period of Eocene extensional tectonics, manifested by the horst and graben structures observed from the Okanagan Valley eastward to Christina Lake. The Franklin Camp and Sappho Property are both located on boundaries of such structures.

Both occurrences are associated with greenstones and ultramafics and are proximal to regional normal faults; if the Paleozoic to Jurassic ultramafic rocks are the platinum group element source, perhaps the PGE were remoblized and leached during deformation and concentrated in contemporaneous alkalic Coryell plutons in the vicinity of the source rocks. Therefore, alkalic bodies in this tectonic setting may be targets for platinum-group element exploration.

ii) Alkalic Hosted Occurrences

FRANKLIN MINING DISTRICT

LOCATION

The Franklin Mining Camp is situated between the Franklin and Glouster tributaries of Burrel Creek, the eastern branch of the North Fork of the Kettle River. The camp is approximately 72 kilometres from Grand Forks. The area is accessed from Grand Forks via the paved Granby Creeks logging road, which follows the north fork of the Kettle River for approximately 40 kilometres to its junction with the Burrel Creek road at kilometre 44 (Cukor, 1982). A secondary dirt road leads into the Franklin Mining Camp.

The first claims in the area, the Banner and McKinley, were staked in 1896. Considerable development was carried out in the area through to 1906 by which time practically all the ground in the mineral belt was staked (Drysdale, 1915).

REGIONAL GEOLOGY

The Franklin Mining Camp is situated within the Omineca Crystalline Belt, near the tectonic boundary between the Quesnel and North America Terranes. The property lies within a tectonically depressed area west of the Granby River fault. This fault forms the eastern boundary of a Tertiary north-northeast trending regional structure, the Republic Graben, which extends southward across the International Boundary (Lisle and Seraphim, 1980).

According to Drysdale (1915), the basal formation of the Franklin Camp is comprised of Carboniferous Franklin Group greenstones, tuffs, argillites and cherty quartzites and Glouster Formation crystalline limestone. The "Paleozoic" rocks occur as roof pendants through the Jurassic age Nelson plutonic complex. Church (pers. comm) correlates Drysdale's Franklin Group greenstones with the Knob Hill Group and argillites with the Permo-Carboniferous Attwood Group. The limestone, previously referred to as Paleozoic Glouster Formation by Drysdale has been redesignated as the Triassic Brooklyn Group (Church, 1985).

Sandstones, conglomerates and tuffs of the Eocene Kettle River Formation are overlain by augite syenites with shonkinite-pyroxenite of the Coryell Formation; these comprise the Penticton Group, which lithologically dominates the Franklin Camp.

LOCAL GEOLOGY

Mineral claims within the Franklin Camp have been staked along the intrusive contacts betweeen the Paleozoic greenstones and limestone with the Nelson granites and Coryell augite syenites.

A pyroxenite unit, referred to by Drysdale (1915) as a skonkinite-pyroxenite, is interpreted to be a basic cumulate or marginal phase of the augite syenite intrusion. Locally known as the "Black Lead", this pyroxenite hosts the mineralization, which occurs as pods, veinlets and disseminations of chalcopyrite, pyrite and copper carbonates at the outer margins of the body.

According to Chilcott and Lisle (1980), the sulphides, chalcopyrite, pyrite, sphalerite and platinum with malachite and azurite present as oxides in a gangue of quartzite and greenstone on the Mountain Lion crown grant, and in a pyroxenite-syenite gangue on the Maple Leaf, Buffalo and Averill crown grants.

OCCURRENCE AND DISTRIBUTION OF PLATINUM GROUP ELEMENTS

Platinum values of up to 15.4 grams per tonne were recorded in 1915 from assays of 'Black Lead' ore obtained from workings on the Maple Leaf Claim (B.C. Annual Reports 1920, page 153; 1929, page C254).

The Maple Leaf claim as well as the Columbia, Ottawa, Evening Star, Iron Hill, Buffalo, Blue Jay, Averill, Mounain Lion, and Lucky Jack Claims all of which are located on the 'Black Lead' (figure 4) were sampled by Wm. Thomlison of the Munition Resource Commission in 1918; his assays substantiated the earlier platinum results. Thomlinson's assays of this study and later data obtained are listed in Table 2. Thomlinson (1918) concluded that the platinum values observed in the ore zone (Black Lead) are proportional to the primary copper sulphides mainly chalcopyrite; the richest copper ore yielded the highest platinum concentrations. Sperrylite (Pt,As_2) is closely associated with sulphides; it is the major platinum mineral.

Mertie (1969) noted the occurrence of platinum within a quartz vein in the Union Mine Camp, located west of the Maple Leaf Claim.

Figure 4. Generalized geology and claims with platinum-group element occurrences in the Franklin Camp (after Drysdale, 1915).

TABLE 2 ASSAYS OF PLATINUM OBTAINED FROM 'BLACK LEAD' IN THE FRANKLIN CAMP, AND DRAINAGE CHANNELS

CLAIM	DESCRIPTION	PLATINUM GRAMS PER TONNE	SOURCE
Maple Leaf	From carlode of picked copper ore shipped from upper workings.	15.4	B.C. Annual Reports; 1920, page 153 1929, page C254
	Samples taken from almost pure mass of chalcopyrite occurring in the pyroxenite near the margin with the augite syenite hanging wall side of the lode.	13.0	Thomlinson, 1920, page 162
	Sample taken from main open cut at upper workings.	5.14, 5.83	Thomlinson, 1920, page 165
Lucky Jack	Dump of pyroxenite at mouth of short drift near west end-line. Selected pieces of dark-coloured close-grained rock with chalcopyrite and small crystals of whitish metallic mineral.	2.74	Thomlinson, 1920, page 163
	From small shaft 200 feet easterly from above sample location. Chalcopyrite and pyrite within lens of dark, close-grained rock.	1.37	Thomlinson, 1920, page 163
	From opencut near east end-line, medium grained pyroxenite with chalcopyrite, pyrite and stained by copper carbonates.	2.06	Thomlinson, 1920, page 163
Mountain Lion	Oxidized pyroxenite and iron sulphide from small shaft and open cut on ridge 1000 feet west of shaft on Gloucester claim.	3.09	Thomlinson, 1920, page 163
	Samples from small shaft and large open cut. Decomposed pyroxenite with reddish-brown iron oxides.	0.69	

TABLE CONTINUED

CLAIM	DESCRIPTION	PLATINUM GRAMS PER TONNE	SOURCE
Golden Age	Oxidized pyroxenite with fine particles of chalcopyrite and stains of copper carbonates from small shaft near southwest of claim.	2.06	Thomlinson, 1920, page 164
Averill Group	From dump at lower drift near the cabin. Coarse grained pyroxenite associated with fine grained syenite, with chalcopyrite and bornite.	3.06	Thomlinson, 1920, page 164
	Dump at upper shaft. As above.	3.06	Thomlinson, 1920, page 164
Buffalo	Dump at old shaft below and near trail at southwest end of claim. Pyroxenite, with small masses of chalcopyrite, some pyrite and copper carbonate.	6.51	Thomlinson, 1920, page 165
	From open cuts in dry ravine below trail near southeast corner, selected pieces with pyrite and chalcopyrite.	2.74	Thomlinson, 1920, page 165
Ottawa	Pyroxenite with magnetite, pyrite and chalcopyrite from large open-cuts in dry ravine below trail near southeast corner.	2.06	Thomlinson, 1920, page 165
Columbia	Pyroxenite with pyrite and chalcopyrite from dumps of two drifts on side-hill north of cabin on north bank of Franklin Creek.	1.37	Thomlinson, 1920, page 165

TABLE CONTINUED

CLAIM	DESCRIPTION	PLATINUM GRAMS PER TONNE	SOURCE
Davenport	Highly mineralized pyroxenite with minute specks of bornite and masses of chalcopyrite from east end of 75 foot long tunnel.	3.77	B.C. Annual Report 1921, page G180
	Panned sample near mouth of Franklin Creek.	1.03	O'Neill and Gunning 1934, page 99
	Panned sample from McDonald Creek.	3.09	O'Neill and Gunning 1934, page 99
	Panned sample from west branch of north fork of Kettle River.	2.06	O'Neill and Gunning 1934, page 99

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ii) Alkalic Hosted Occurrences

SAPPHO

LOCATION

The Sappho property is located 8 kilometers south of Greenwood and 5 kilometres east of Midway on the International Boundary. Access is from Highway 3, about 3 kilometres east of Midway to the Norwegian Creek road which is followed southeasterly for about 3 kilometres until it crosses Norwegian Creek. From here, a 0.2 kilometre hike along an old wagon trail leads into the old workings.

REGIONAL AND LOCAL GEOLOGY

The Sappho Crown Grant is situated on the eastern fault boundary of the north-northeast-trending Tertiary Toroda Creek graben, within the Omineca belt of British Columbia. Interpretation of the geology of the area has been hampered by extensive Eocene extensional tectonics. Late Paleozoic Knob Hill greenstones occur as roof pendants through a Triassic microdiorite (Church, 1985). Tertiary Coryell alkalic intrusives (shonkinites, feldspar porphyry dykes) occur within the central and northeastern portions of the Sappho claim. A serpentine schist body of unknown age occurs several hundred metres to the north of the claim and sheared serpentine fragments have been found in the dumps of some old workings in the area of the claims (Church, 1983).

DISTRIBUTION AND OCCURRENCE OF P.G.E.

Platinum values of 1.0 gram per tonne were obtained from chalcopyrite-rich ore within a pyroxenite, in 1927 (O'Neill and Gunning, 1934). Subsequent rock sampling and trenching of the copper mineralization in the pyroxenite, done in 1975, 1978 and 1981, confirmed the presence of platinum; by assays of up to 1.75 grams per tonne platinum were found (Gilmour, 1981).

The host to the copper-platinum mineralization is variably identified as Coryell shonkinite, a pyroxene-rich marginal phase of an alkalic intrusive, by Church (1985) and a serpentinized and foliated syenodiorite to gabbro by Gilmour (1981). Copper, silver and platinum mineralization occur as blebs and disseminations in shear zones or are associated with a skarn-like zone of strong biotite, garnet and chlorite alteration (Gilmour, 1981) near the margin between the mafic rocks and the intrusive microdiorite stock. The highest platinum assay (1.75 grams per tonne - Gilmour, 1981) was obtained from a 50 cm. long pod of massive chalcopyrite within sheared and extensively (biotite, garnet and calcite) altered upper Paleozoic greenstones (Gilmour, 1981); these would correspond to the Tertiary biotite shonkinite of Church (1983). According to Fyles and Keating (1984), the Sappho showings are situated at or close to the point where a north-northeast trending zone of Eocene normal faulting associated with the regional Toroda Creek graben crosses the altered mafic volcanic rocks. Evidently, no agreement exists about either the nature of the host rocks or their ages.

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MISCELLANEOUS (CONTINUED)

iii) Platinum-Group Element Occurrences in Skarns, Porphyry Copper and Stratabound Lead-Zinc Deposits

Smelters at the Nickel Plate and Copper Mountain-Ingerbelle Mines recorded trace platinum. The Sullivan Mine, is presumed to be the source of palladium and platinum recovered as by-products of refining at the Trail Smelter during the period 1928-1930.

SULLIVAN MINE

The Sullivan Mine is a stratabound Pb-Zn-Ag deposit located near Kimberley, British Columbia. The ore is confined and conformable to Aldridge Formation metasedimentary rocks of the mid-Proterozoic Purcell Supergroup. According to O'Neill and Gunning (1934, Page 107) palladium and platinum, worth $25,365.00 and $3,177.00 (1928-1930 prices) respectively, were recovered "as a by-product of refining at the Trail plant of the Consolidated Mining and Smelting Company of Canada".

No platinum or palladium has been reported, however, in recent and routine analyses of lead or zinc concentrates and of pyrrhotite which have failed to indicate platinum or palladium above detection limits of 50 ppb (Hamilton, J., 1986, pers. comm.).

O'Neill (1919), remarks that palladium was noted at the Trail Smelter of the B.C. Consolidated property, in association with copper-gold ore.

iii) Platinum-Group Element Occurrences in Skarns, Porphyry Copper, and and Stratabound Lead-Zinc Deposits (Continued)

NICKEL PLATE MINE

At the Nickel Plate Mine, auriferous arsenopyrite and bismuth telluride ore occurs at the outer margins of a pyroxene skarn zone between limy clastic rocks and calcareous sediments of the Nicola group, and diorite porphyry sills of the Hedley Intrusions. Assays of 0.5 percent platinum, occurring as sperrylite ($PtAs_2$), were reported from a residue on the plates at the stamp mill at the mine (Camsell, 1910, page 137).

COPPER MOUNTAIN

Chalcopyrite and bornite as disseminated blebs and fracture fillings mineralization occur within highly fractured Upper Triassic Nicola Group bedded tuffs and andesites which have been intruded by the alkalic Copper Mountain intrusions. According to O'Neill and Gunning (1934, Page 103); "Jules Catharinet (1905) mentions reports of platinum assays from Copper Mountain and claims to have identified sperrylite in a pegmatite on the Copper Cliff claim. Minute crystals and grains are said to have been observed in biotite in a thin section and in bornite and chalcopyrite microscopically".

Recent analyses of sulphide concentrates obtained from the Copper Mountain - Ingerbelle Mine substantiate the presences of palladium and platinum in the ore (Mutschler, et al., in press).

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TABLE 3. PLATINUM GROUP ELEMENT PLACERS IN BRITISH COLUMBIA

River	Tributary	Description	Assay	Source
Similkameen		On Pedersons Flat, 4 miles above Princeton platinum occurs in gravels	$0.60/yd ($115/oz)	MMAR 1924, p.B176
		Combined black sand from two pans of sandstone bedrock on Tulameen River, 2 miles above Princeton on south bank of river	200.9 g/t	MacKenzie, 1920, p.150
		One pan of river gravel 2 miles above Princeton on south bank of river	239.3 g/t	MacKenzie, 1920, p. 150
Tulameen (92H/7)		Platinum was recovered along the Tulameen from its mouth near Princeton, to the mouth of Granite Creek (approximately 12 miles) and between the mouths of Olivine and Champion Creeks. Champion Creek, Brakeburn Creek, Newton Creek which all have their sources in the ultramafic complexes, bear platinum and iridium in their gravels. Other platinum-bearing tributaries to the Tulameen are Cedar Creek, Slate (Olivine), Bear, Pine, Eagle, Otter and Boulder		
Tulameen	Bear Creek (92H/5)	Combined black sand and gravel from two pans of medium-sized gravel from Tulameen River at mouth of Bear Creek	1733.5 g/t	MacKenzie, 1920, p.150
Tulameen	Slate (Olivine) Creek (92H/10)	Combined black sand from five pans of medium-sized gravel from Tulameen River at mouth of Slate (Olivine) Creek	600.3 g/t	MacKenzie, 1920, p.150

River	Tributary	Description	Assay	Source
Tulameen	Slate (Olivine) Creek (92H/7)	Combined black sand from three pans of medium-sized gravel from Tulameen at mouth of Slate (Olivine) Creek	1316.6 g/t	Mun. Res. Com., 1920, p.150
		Washings of 90 cubic yards of gravel on Tulameen River opposite Slate Creek	8.46 g/t	Mun. Res. Com., 1920, p.152
Tulameen	Granite Creek (92H/7)	Analyses of 17.89 grams of native platinum from Granite Creek, (a) non-magnetic and (b) magnetic separations. Granite Creek has been mined from the Tulameen River to Newton Creek where the gold to platinum ratio was 4:1	Pt (a) 68.19% (b) 78.43% Pd (a) 0.29% (b) 0.09% Rh (a) 3.10% (b) 1.70% Ir (a) 1.21% (b) 1.40% OsIr (a) 14.62% (b) 3.77%	GSCAR 1899, p.5-9
Tulameen	Siwash Creek (92H/11)	Platinum is reported to occur with gold in black sands		MMAR 1911, p.K183
Coquihalla	Sowoqua (92H/6)	Drains Coquihalla River 1.5 miles below Jessica. "Platinum values are claimed by owners" in areas underlain by serpentines of the Coquihalla Belt		MMAR 1922, p.N143
Okanagan	Shuttleworth (82E/5)	Evidence of presence of platinum but not in commercial quantities		Mun. Res. Com., 1920, p.168-169; Camsell, 1919, p.28B
Kettle	Rock Creek (82E/5)	"Platinum occurs in exceedingly minute to moderate sized, coarse irregularly shaped grains, the largest of which measures 4 mm in diameter; a little chromite was detected in one of the pellets of platinum"		GSCAR 1892-93, p.14

River	Tributary	Description	Assay	Source
Kettle	Rock Creek (82E/5)	Sample of heavy black sand taken from riffles of sluice boxes at Camp McKinney	44% native platinum	GSCAR 1892-93, p.14
Kettle	Franklin (82E/9)	Analyses of black sands and pannings taken near mouth of Franklin Creek	1.03 g/t	Mun. Res. Com., 1920, p.167
		Black sand pannings from McDonald Creek, branch of Franklin Creek	3.09 g/t	Mun. Res. Com., 1920, p.167
Lardeau (82K/2)		"Pannings from bar below small canyon at bridge on road to Truine Mine"	1.37 g/t	Mun. Res. Com., 1920, p.171
		"Pannings from Ninemile point, near old cabin above falls"	0.34 g/t	Mun. Res. Com., 1920, p.171
		"Pannings from bar at Eightmile point just above bridge on road to Silver Cup Mine"	5.49 g/t	Mun. Res. Com., 1920, p.171
		"Pannings from bars at mouth of Finkle Creek which enters river from north at Sevenmile point, near Livingstone's Camp"	4.11 g/t	Mun. Res. Com., 1920, p.171
		"Pannings from bars 300 to 500 yds above old power house of Silver Cup mill, about 6 miles from Ferguson"	4.11 g/t	Mun. Res. Com., 1920, p.171
		"Discarded 'black sand' found lying near cabin at placer workings one half mile from Ferguson, and mouth of North Fork"	0.69 g/t	Mun. Res. Com., 1920, p.171
		"Pannings from North fork of Lardeau River. Mainly from bars below small canyon about 2 1/2 miles from Ferguson"	3.77 g/t	Mun. Res. Com., 1920, p.171

River	Tributary	Description	Assay	Source
Lardeau (82K/2)		"Pannings from North fork of Lardeau River. Small bars in canyon below wagon-road bridge, about 1/2 mile from Ferguson"	1.03 g/t	Mun. Res. Com., 1920, p.171
		"Lardeau River, Bench placer on main river near Ferguson townsite"	0.34 g/t	Mun. Res. Com., 1920, p.171
		"Black sand said to be from small bars in centre of main canyon of the Lardeau River, halfway between Trout Lake and Ferguson"	7.54 g/t	Mun. Res. Com., 1920, p.172
		"Pannings from bars near mouth of canyon, Lardeau River about one half mile north of town of Trout Lake"	5.83 g/t	Mun. Res. Com., 1920, p.172
Lardeau	Five-mile Creek (82K/2)	Material from panning	3.09 g/t	Mun. Res. Com., 1920, p.172
Lardeau	Cañon Creek, near Gerrard (82K/2)	Material from panning	0.69 g/t	Mun. Res. Com., 1920, p.172
		Pannings from Lardeau River near mouth of Cascade Creek	1.37 g/t	Mun. Res. Com., 1920, p.173
		"Pannings from bars near old dredge at Gold Hill, Lardeau River; also from point on South side of channel for about 1 mile up-stream from dredge"	1.37 g/t	Mun. Res. Com., 1920, p.173
		"Pannings from bars near old dredge and along south side of channel, for about 1/2 mile downstream from dredge"	0.69 g/t	Mun. Res. Com., 1920, p.173
Columbia	Toby Creek (82K/8,9)	Platinum reported mixed with coarse gold		O'Neill, 1919, p.106

River	Tributary	Description	Assay	Source
Columbia	Isaac Creek (82K/9)	"Pannings from bars along south bank of Isaac Creek, for 3/4 of a mile upstream from a point 1/2 mile above falls"	1.37 g/t	Mun. Res. Com., 1920, p.175
		"Bars along Isaac Creek for 3/4 of a mile upstream from a point 1 1/4 miles above falls"	0.69 g/t	Mun. Res. Com., 1920, p.175
		"Bars along Isaac Creek for one-half mile upstream from a point 2 miles above falls"	0 g/t	Mun. Res. Com., 1920, p.175
Thompson	Clearwater (92P/9)	Near mouth of Clearwater, traces of platinum recorded. Samples of black sand sent to Baker and Co. - Newark, New Jersey (platinum refiners)	4251 g/t	MMAR 1900, p.894; 1901, p.1082
Thompson	Tranquille (92I/10)	Pannings from points along Tranquille River, near schoolhouse, upstream to Sharps cabin, a distance of 1/2 mile	0 g/t	Mun. Res. Com., 1920, p.176
		Pannings from points along Tranquille River from Sharps cabin to main canyon, a distance of 1 mile	0.69 g/t	Mun. Res. Com., 1920, p.176
Thompson	Criss Creek (tributary of Deadman River) (92I/15)	Sample concentrated from the gravels in a pit at the junction of Criss Creek and Deadman River	4.11 g/t	O'Neill and Gunning, 1934, p.88
Bonaparte	Scottie Creek (92I/14)	Pannings from bars and old workings between Hunter ranch and dam at Chinese workings	0.34 g/t	Mun. Res. Com., 1920, p.177
		Pannings from bars along creek from dam at old diggings to a point below canyon. Gold may contain iridium, osmium, ruthenium, rhodium	0 g/t	Mun. Res. Com., 1920, p.177

River	Tributary	Description	Assay	Source
Bonaparte	Scottie Creek (92I/14)	Pannings from cabin on Gagne's claims to old shaft on low bench near creek, a distance of 1/3 mile	4.80 g/t	Mun. Res. Com., 1920, p.178
		Pannings from bars along Scottie Creek near old shaft on Gagne's claims to mouth of Chrome Creek, a distance of about 2/3 mile	1.37 g/t	Mun. Res. Com., 1920, p.178
Bonaparte	Chrome Creek (92I/14)	Pannings from mouth upstream for about 1/4 mile	2.06 g/t	Mun. Res. Com., 1920, p.178
		Pannings from 1/4 mile from mouth to a point opposite the Chromite claims, a distance of about 1/2 mile	2.06 g/t	Mun. Res. Com., 1920, p.178
Fraser	(92H/6)	Platinum has been found in placers along the Fraser River from a few miles below the mouth of Quesnel River to a few miles north of Hope		
	(92H/11)	Black sands near Yale - average of 6 samples of 5 assay tons each	13.7 g/t	O'Neill and Gunning, 1934, p.101
		Black sands opposite Saddle Rock Station, near Yale	4.80 g/t	O'Neill and Gunning, 1934, p.101
	(92H/14)	Boston Bar - a little platinum recovered in concentrates from dredge samples		O'Neill and Gunning, 1934, p.101
	(92H/14)	North Bend - platinum reported in black sands		O'Neill, 1919, p.107

River	Tributary	Description	Assay	Source
Fraser	(92I/12)	4-5 miles south of Lillooet on east side of river, platinum obtained from cleaning up concentrating tables of old dredge at Lillooet. "Platinum was in fair sized flakes and Dawson reports the occurrence of the metal in very fine scales, with gold, about 10 miles below Lillooet"	17.1 g/t	GSCAR 1887-88, p.156; O'Neill and Gunning, 1934, p.101
	(92I/5)	Cobledick Dredge - at the Van Winkle bar near Lytton, platinum and iridium occur in black sands	5681.1 g/t	O'Neill and Gunning, 1934, p.101; B.C.O.F. 92I-4E
	(92I/12)	Fosters Bar - 23 miles north of Lytton platinum occurs with gold in black sands. Assay results were obtained from four 1-ton concentrates	174.2 g/t 199.9 g/t 141.3 g/t 291.4 g/t	B.C.O.F. 92I/NW-89
	(92N/1)	Glascow - 18 miles southeast of Clinton; platinum occurs in gravel benches, terraces and beaches. Emission spectrography of a 1.6 oz of 'platinum' sample indicated 0.5 oz platinum, 1.0 oz palladium and 0.1 oz other constituents	Pt 21.6 g/t Ir 0.69 g/t	Geiger, 1970
		Sample of black sand taken from Fraser River at mouth of Quesnel River	Pt 71% Os 3.1%	O'Neill and Gunning, 1934, p.101
		Sample of black sand taken 2 miles above Quesnel River mouth	82.3 g/t	O'Neill and Gunning, 1934, p.101
		Black sand, 3 miles above Quesnel River mouth	Pt 8.6 g/t OsIr 109.7 g/t	O'Neill and Gunning, 1934, p.101

River	Tributary	Description	Assay	Source
Fraser	(92N/1)	Black sand, 15 miles above Quesnel River mouth	133.7 g/t	O'Neill and Gunning, 1934, p.101
	Lillooet River (92G/16W)	Platinum, palladium and iridium occur in sands with gold and silver. (a) PML 811, (b) PML 813	(a) Pt 1.44 g/t Pd 1.06 g/t Ir 0.07 g/t (b) Pt 1.58 g/t Pd 0.69 g/t Ir 0.07 g/t	B.C.D.F. 92GNE013 B.C.D.F. 92GNE019
	Quesnel River (93A/14)	Head of Harvey Creek	0 g/t	O'Neill and Gunning, 1934, p.84
	(93A/14)	Upper Cunningham Creek	0 g/t	"
	(93A/7)	Eureka Creek	0 g/t	"
	(93A/11)	Keithly Creek	0 g/t	"
		Black sands, 82 miles above mouth	34.3 g/t	"
	(93B/16)	Black sands, 40 miles above mouth	96.0 g/t 4.8 g/t	"
	(93B/16)	Black sands, 25 miles above mouth	13.7 g/t	"
	(93B/16)	Black sands, 13 miles above Quesnel	267.4 g/t	"
		Black sands, 30 miles above Quesnel	219.4 g/t	"
	(93A/12)	Black sands, 25 miles below forks	17.1 g/t 85.7 g/t	"
	(93G/1)	Three miles above Quesnel	8.6 g/t	"
	(93A/6)	Horsefly River - platinum reported in small quantities with gold	0 g/t	O'Neill and Gunning, 1934, p.83

River	Tributary	Description	Assay	Source
Fraser	Quesnel River (93A/5)	Bullion pit - platinum, osmiridium and palladium are present in the heavy concentrates that remain in the sluices after cleaning up and also in gravels as fine grains	0 g/t	O'Neill and Gunning, 1934, p.85; MMAR 1928, p.C201
	Cottonwood (93G/2)	Platinum and iridium occur in gravels in river bars, benches of gravel and deposits in rock benches where the river crosses ultrabasic rocks	0 g/t	MMAR 1936, p.C19
Quesnel	Morehead Creek (93A/12)	On the south bank of the Quesnel River at mouth of Morehead Creek, crude platinum was reported by Watertight Dipper Dredge and Mining Co. Ltd. of Calgary		MMAR 1913, p.62
Quesnel	Twenty Mile Creek (93A/12)	Platinum, palladium and osmiridium are found in minute metallic grains and enclosed in small fragments and nuggets of magnetite and chromite. Analysis of sample of a pan of concentrates taken from the sluices after cleanup	Pt 2194.3 g/t Pd 2208.0 g/t Os 1440.0 g/t	Uglow, 1920, p.215
Fraser	Government Creek (tributary of Hixon Creek) (93G/9)	Platinum in black sands was recorded in creek beds and shallow covered benches	96.0 g/t	O'Neill and Gunning, 1934, p.83; MMAR 1919, p.K128
Parsnip	McLeod (93J/14)	Iridium and platinum occur with gold in shallow gravels on rock benches and also in the cracks and crevices of the rock under the gravel. Pyroxene intrusions nearby suggest a source for the platinum group elements		MMAR 1932, p.A88

River	Tributary	Description	Assay	Source
Parsnip	McLeod (93J/14)	C. Nelson's claim, located at the lower end of a low-lying rock bench, 1/2 mile south of the mouth of the McDougall River	8.6 g/t	MMAR 1932, p.A88
		Sample of black sands from which gold had been removed by amalgamation - from Cluckhoot claim, 1 1/2 miles below mouth of McDougall River on McLeod River on the right bank	$4500/t Pt $780/t Ir (1931 price)	MMAR 1932, p.A89
Parsnip	(93O/13E)	Platinum was reported to occur with gold in sands at Bill Custs Bar which is now flooded by Williston Lake		MMAR 1894
Nation	Rainbow Creek (93O/4W)	Platinum and iridium occur in black sands in the canyon. Ratio of platinum to gold averages 1:2	$96/t Pt, Ir (1931 price)	O'Neill and Gunning, 1934, p.82
Stuart	Dog Creek (93K/8)	Platinum occurs with gold in gravels overlying false bedrock on extensive bench near creek	$0.01/yd^3	MMAR 1931, p.80
Ingenika	McConnell Creek (94D/16)	Trace platinum and palladium occur with gold in terraced gravel floor along McConnell Creek and within 1 to 8-foot-deep pockets of sand, gravels and boulders which extend from the mouth of McConnell Creek, 10 miles down the Ingenika River		O'Neill and Gunning, 1934 p.83
		Highest platinum value from north end of a pit, 3 feet deep on Lease No. 457	$0.68/yd^3 (1932 price)	O'Neill and Gunning, 1934 p.83
		Sample of black sand after gold removed by amalgamation	$45.2 Pt/t (1932 price)	O'Neill and Gunning, 1934 p.83

River	Tributary	Description	Assay	Source
Manson Creek	(93N/9)	Platinum reported in placers along creek		O'Neill, 1919, p.106
Germanson	Ah Hoo (93N/10)	At Ah Hoo Creek a belt of nickeliferous (0.18%) serpentine is cut by the creek. Below this point placer deposits contain small amounts of platinum		MMAR 1936, p.C6
Peace	(94B/4)	Sample of black sand concentrate (971 lbs) obtained from top 8 inches of bar gravels on Pete Toy Bar, 3 miles above Finlay Forks. This area is now flooded by Williston Lake	33.3 g/t	O'Neill and Gunning, 1934, p.82
Peace	(94B/2)	Placer platinum has been reported to occur with gold at the upper end of Rocky Mountain Canyon and the junctions of the Finlay and Parsnip Rivers with the Peace River, at Branhams Flats. This area is flooded by the Portage Mountain Dam		Mun. Res. Com., 1920, p.156-160
	(94B/3)	"Platinum has been found in small amounts in the bars and benches of the upper Peace River, chiefly between Hudson's Hope and the Ne Parle pas rapids"	$0.80/yd (1918 price)	Uglow, 1920, p.218; O'Neill and Gunning, 1934, p.83
Peace	McLean Creek (93P/4) MacDonald Creek	Platinum occurrence is by report only		O'Neill, 1919, p.106
Dease	Thibert Creek (104J/15)	Platinum and osmium occur in black sands in gravels on Thibert Creek below mouth of Berry Creek. The richest gravels are only a few feet thick and rest on bedrock. Serpentinites occur along Thibert fault		O'Neill and Gunning, 1934, p.76-77; MMAR 1905, p.77-78

River	Tributary	Description	Assay	Source
Dease	Thibert Creek (104J/15)	Analyses of black sand remaining in the sluice boxes and undercurrents	44.1% Pt 11.9% Os, Ir	MMAR 1902, p.44
		Assays of concentrates from top gravel obtained from (a) B.C. Government Assay office and (b) San Francisco	(a) Pt 2057.1 g/t (b) Pt 514.3 g/t	
Atlin Lake	Ruby Creek (104N/11)	Crystals and grains of iridosmine were obtained from black sands on Ruby Creek		O'Neill and Gunning, 1934, p.80-81
Atlin Lake	Boulder Creek (104N/11)	Assay taken from black sand concentrate	2.7 g/t	B.C.O.F. 104N/5, 6,11,12
Graham Island (103J/4)		Platinum has been reported in the beach sands on the northeast coast of Graham Island from Toe Hill to Rose Point. However this was not substantiated by Munitions Resource Commission		O'Neill and Gunning, 1934, p.81
Vancouver Island	Wreck Bay (Florencia Bay) (92C/13)	Platinum was detected in two samples of auriferous black beach sands	1.7 g/t 1.0 g/t	O'Neill and Gunning, 1934, p.100
Jervis Inlet	Potato Creek (92J/4)	Platinum occurs in gravel bars, pits and benches in the main channel of Potato Creek	0.69 g/t 5.8 g/t	Mun. Res. Com., 1920, p.182

GSCAR - Geological Survey of Canada Annual Report
MMAR - Minister of Mines, B.C. Annual Report
Mun. Res. Com. - Munition Resources Commission
B.C.O.F. - British Columbia Open File
g/t - grams per tonne

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KILOMETRES 50

BEDDED ROCKS

ASSEMBLAGE

MISSISSIPPIAN-TRIASSIC

SLIDE MOUNTAIN-SYL

THOMPSON

CACHE CREEK-ANVIL

SICKER-SKOLAI

IGNEOUS INTRUSIONS

MID-CRETACEOUS

ALASKAN-TYPE ULTRA

UPPER TRIASSIC-LOWER JURAS

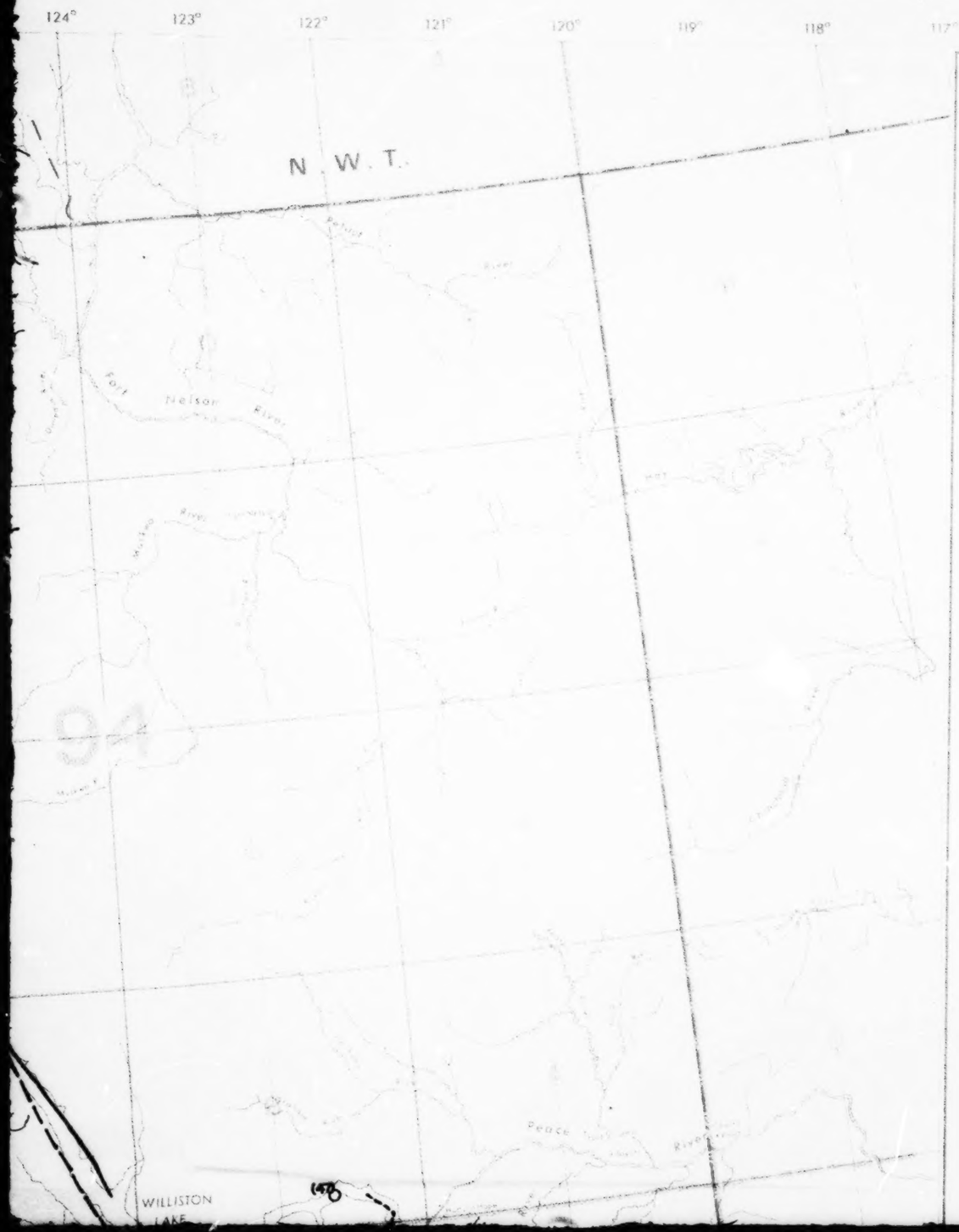
ALASKAN-TYPE ULTRA

LATE PALEOZOIC-TRIASSIC

ALPINE-TYPE ULTRA

TRANSFORM F

NORMAL FAUL



BC

Geological Survey Branch
Ministry of Energy, Mines and Petroleum Resources
Province of British Columbia

OPEN FILE 1986-7

PLATINUM GROUP ELEMENT OCCURRENCES IN BRITISH COLUMBIA

SCALE 1:2 000 000

KILOMETRES 50 0 50 100 150 200 KILOMETRES

LEGEND

BEDDED ROCKS

ASSEMBLAGE	GROUP	LITHOLOGY
MISSISSIPPIAN-TRIASSIC		
SLIDE MOUNTAIN-SYLVESTER	Antler, Milford, Kaslo Tsalkom, Lay Range, Guyet, Slide Mountain, Sylvester, Fennel	upper: marine diabase, local gabbro, alpine ultramafics lower: chert, argillite, sandstone, conglomerate
THOMPSON	Kobau, Thompson, Churchill Covada, Mount Roberts, Knob Hill, Brooklyn, Attwood	marine volcaniclastics, chert, argillite, limestone, local basalt
CACHE CREEK-ANVIL RANGE	Bridge River, Hozameen, Darrington, Shuksan, Marble Canyon, Chapperon, French Range, Nakina, Cache Creek, Kedahda, Pavillion, Anvil Range	marine and non-marine basalt, limestone, argillite, chert, melange
SICKER-SKOLAI	Sicker, West Coast, Skolai, Buttle Lake	marine and non-marine (locally) basalt, andesite, rhyolite, tuff, carbonate, argillite, chert

IGNEOUS INTRUSIONS

MID-CRETACEOUS		
ALASKAN-TYPE ULTRAMAFICS	Alaskan Panhandle	dunite, peridotite, pyroxenite, hornblendite, gabbro, diorite
UPPER TRIASSIC-LOWER JURASSIC		
ALASKAN-TYPE ULTRAMAFICS	Tulameen, Turnagain River, Polaris, Lunar Creek, Mesilnka, Wrede Creek	dunite, peridotite, pyroxenite, hornblendite, gabbro, diorite
LATE PALEOZOIC-TRIASSIC		
ALPINE-TYPE ULTRAMAFICS	Bralorne, Twin Sisters, Shulaps, Cassiar, Wahlin, Trembleur	dunites, peridotites

SYMBOLS

TRANSFORM FAULT .....

THRUST FAULT, TEETH ON UPPER PLATE .....

NORMAL FAULT, TEETH ON UPPER PLATE .....

PACIFIC

OCEAN

(49)

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SICKER-SKOLAI

IGNEOUS INTRUSIONS

MID-CRETACEOUS

ALASKAN-TYPE ULTRA

UPPER TRIASSIC-LOWER JURAS

ALASKAN-TYPE ULTRA

LATE PALEOZOIC-TRIASSIC

ALPINE-TYPE ULTRAM

TRANSFORM F

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NORMAL FA

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PLATINUM-GR

CHROMITE OC

NICKEL OCCUR

DRAINAGE W

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HECATE STRAIT

TUTSUK LAKE

McNAUGHTON

A L B

	Pavillion, Anvil Range	
SICKER-SKOLAI	Sicker, West Coast, Skolai, Buttle Lake	marine and non-marine (locally) basalt, andesite, rhyolite, tuff, carbonate, argillite, chert
IGNEOUS INTRUSIONS		
MID-CRETACEOUS		
ALASKAN-TYPE ULTRAMAFICS	Alaskan Panhandle	dunite, peridotite, pyroxenite, hornblendite, gabbro, diorite
UPPER TRIASSIC-LOWER JURASSIC		
ALASKAN-TYPE ULTRAMAFICS	Tulameen, Turnagain River, Polaris, Lunar Creek, Mesilnka, Wrede Creek	dunite, peridotite, pyroxenite, hornblendite, gabbro, diorite
LATE PALEOZOIC-TRIASSIC		
ALPINE-TYPE ULTRAMAFICS	Bralorne, Twin Sisters, Shulaps, Cassiar, Nahlin, Trembleur	dunites, peridotites

SYMBOLS

TRANSFORM FAULT .....

THRUST FAULT, TEETH ON UPPER PLATE .....

NORMAL FAULT, TEETH ON UPPER PLATE .....

UNDEFINED FAULT .....

PLATINUM-GROUP ELEMENT LODE OCCURRENCE .....

PLATINUM-GROUP ELEMENT PLACER OCCURRENCE .....

CHROMITE OCCURRENCE .....

NICKEL OCCURRENCE .....

DRAINAGE WITH REPORTED PLATINUM VALUES, POTENTIAL VALUES ~~~, - - - -

Legend and geology modified from Geological Survey of Canada Map 1050A, 1981 and Parrish et al., 1985 in Field Guides to Geology and Mineral Deposits in the Southern Canadian Corillera-GSA Section Meeting, May, 1985.

Compiled by V.J. Rublee, June 1986.

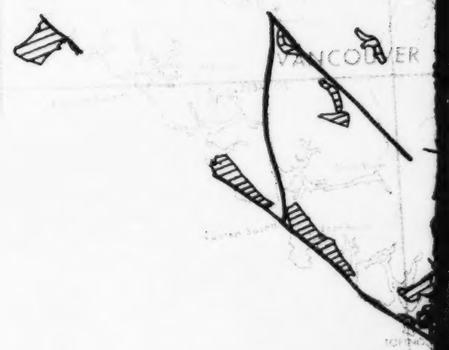
OCEAN

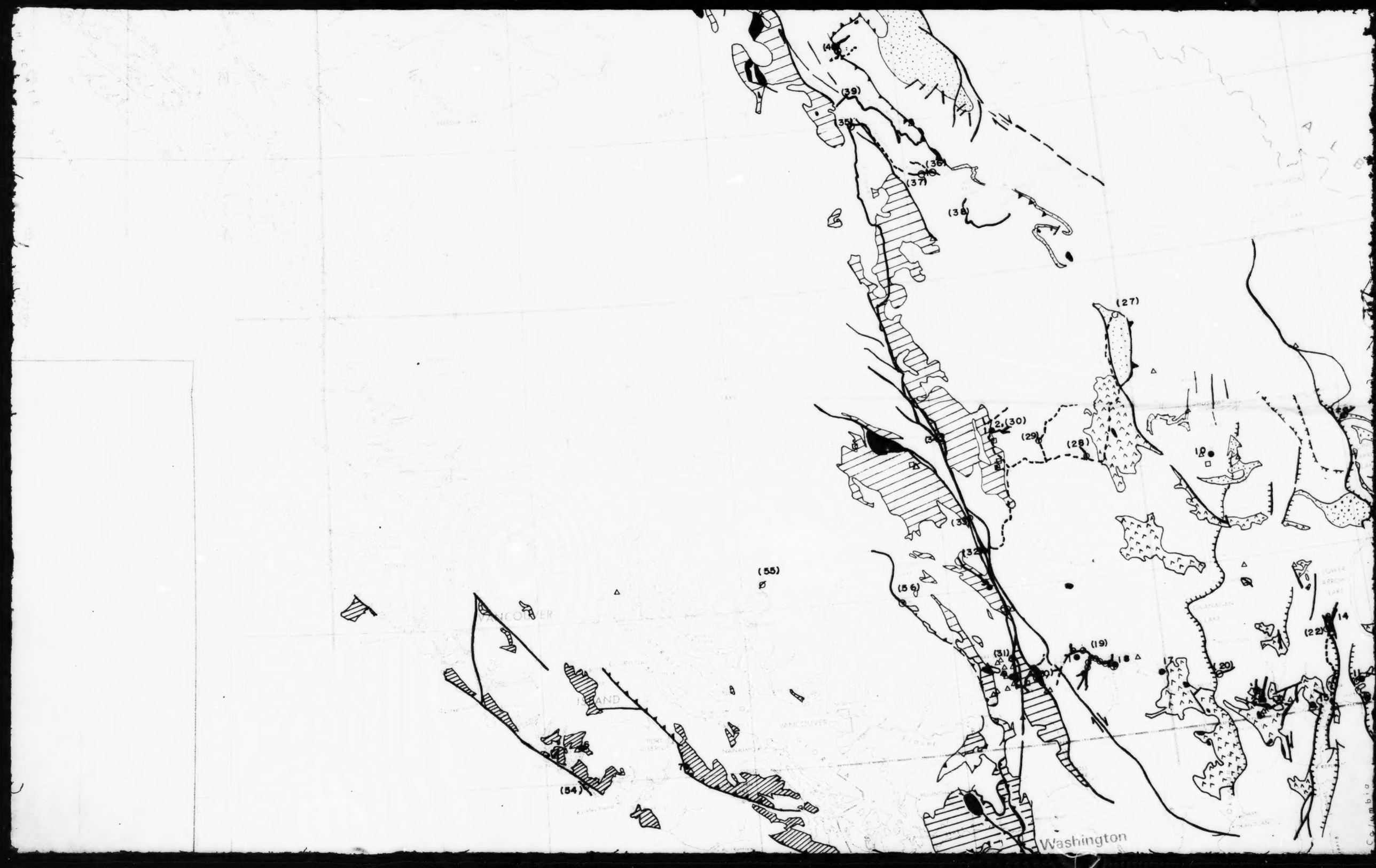
LODE

1. Tulameen
2. Scottie Creek
3. Keefers
4. Mastodon
5. Swede
6. Tofino Nickel
7. Kitkat
8. Mineral Dyke
9. Giant Mascot
10. Mt. Ida
11. Mother Lode
12. Nome
13. Cable
14. Franklin
15. Sappho
16. Sullivan
17. Nickel Plate
18. Copper Mountain

PLACER

(19) Tulameen River
(20) Shuttleworth Creek
(21) Rock Creek
(22) Franklin Creek
(23) Kaslo River
(24) Toby Creek
(25) Lardeau River
(26) Isaac Creek
(27) Clearwater River
(28) Tranquille River
(29) Criss Creek
(30) Scottie Creek
(31) Yale
(32) Van Winkle Bar
(33) Foster's Bar
(34) Glascow
(35) Quesnel River
(36) Bullion Pit
(37) Twenty-Mile Creek
(38) Horsefly River
(39) Cottonwood River
(40) Hixon Creek
(41) Dog Creek
(42) McLeod River
(43) Rainbow Creek
(44) Bill Cust's Bar
(45) Manson Creek
(46) Ah Hoo Creek
(47) Branham Flats
(48) Pete's Toy Bar
(49) McConnel Creek
(50) Thibert Creek
(51) Ruby Creek

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LODE

1. Tulameen
2. Scottie Creek
3. Keefers
4. Mastodon
5. Swede
6. Tofino Nickel
7. Kitkat
8. Mineral Dyke
9. Giant Mascot
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11. Mother Lode
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PLACER

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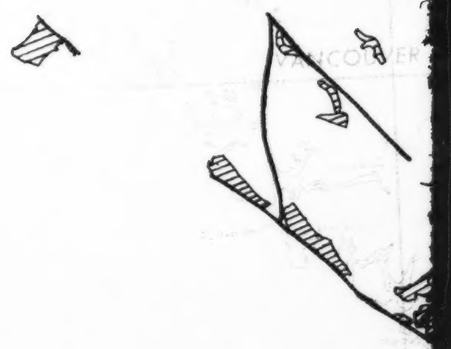
(46) Ah Hoo Creek
(47) Branham Flats
(48) Pete's Toy Bar
(49) McConnel Creek
(50) Thibert Creek
(51) Ruby Creek
(52) Boulder Creek
(53) Toe Hill
(54) Wreck (Florencia) Bay
(55) Potato Creek
(56) Lillooet River

THIS PROJECT IS A CONTRIBUTION TO THE CANADA-BRITISH COLUMBIA MINERAL DEVELOPMENT AGREEMENT, 1985-1990

Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

Province of British Columbia
Ministry of Energy, Mines and Petroleum Resources



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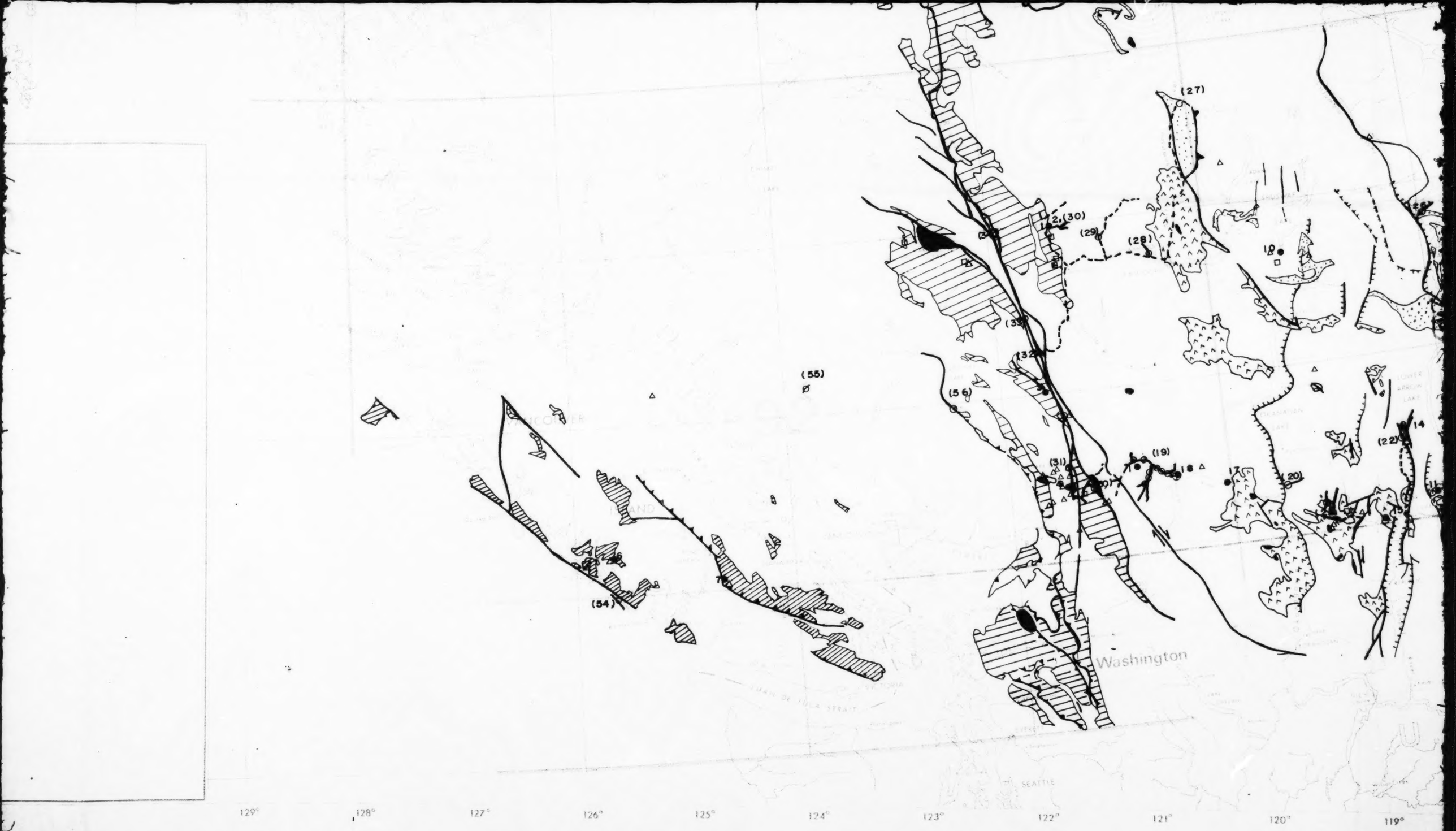
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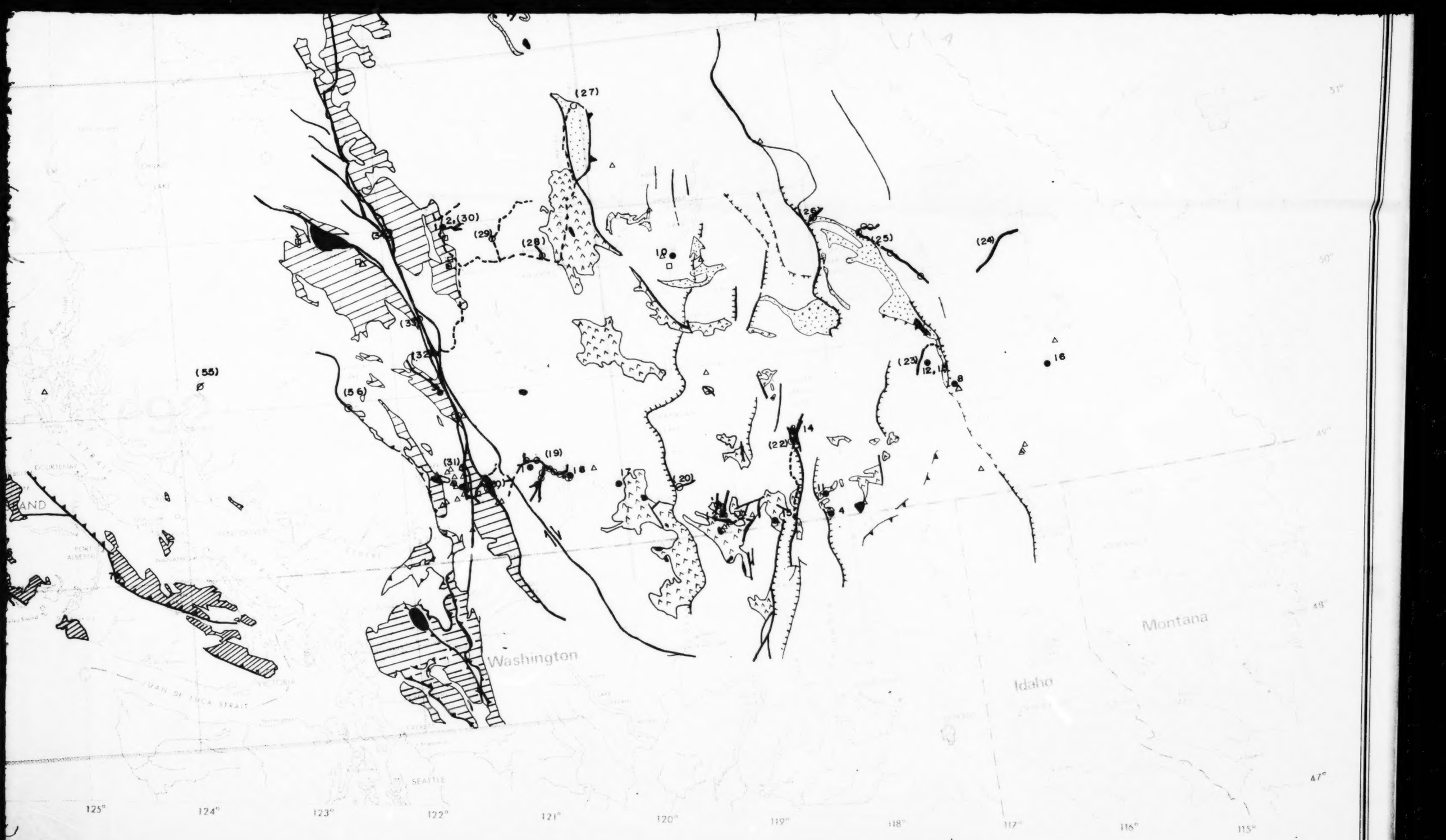
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